

Summary of Research Programs

In the Channel Islands National Marine Sanctuary

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Biological Monitoring in the Channel Islands National Marine Sanctuary

The biological diversity of California's Channel Islands has attracted the attention of naturalists, marine scientists, fisheries biologists, fishermen, divers, and tourists for over a century. Thousands of articles, academic papers, and videos document distributions and abundances of marine organisms and their habitats around the islands. Biologists have thoroughly explored the Channel Islands, cataloguing species that inhabit rocky intertidal habitats, sandy beaches, kelp forests, subtidal rocky reefs, and soft bottom habitats. Local universities have educated thousands of graduate students, who often find the subjects of their research projects in the waters around the Channel Islands. The wealth of information about the biology of the Channel Islands region now provides an historical baseline, which can be used by management agencies to evaluate new management strategies.

Until now, much of the research in the Channel Islands has occurred against the backdrop of recreational and commercial fishing. In the case of targeted species, there was little opportunity to assess the effects of fishing. Only one small area, known as the Anacapa Island Ecological Reserve Natural Area, has been fully protected from fishing since 1978.

In 2003, the California Department of Fish and Game implemented a network of marine protected areas (MPAs) throughout the Channel Islands (see map). Over time, scientists anticipate that biomass will increase in the MPAs and larger populations in protected areas may contribute to those in surrounding waters. If the newly established MPAs function in a similar way to the Anacapa Natural Area and other protected areas worldwide, it is likely that abundance and size of fished species will increase, leading to greater reproductive potential. In addition, species that are not targeted by fishing may be affected by protection as population sizes of predator or prey species change.

In order to detect these changes, it is essential to monitor marine systems within and around MPAs. Numerous monitoring programs already exist in the Channel Islands region. Many of these programs can provide the information necessary to assess the ecological impacts of protected areas. However, the existing programs were not designed within the context of the newly established MPAs. Some existing monitoring sites may not be located in any of the protected areas whereas others may be located only in protected areas. As a consequence, existing programs may need to be modified or expanded, and new programs may need to be developed, in order to assess the ecological impacts of protected areas.

This summary of monitoring programs in the Channel Islands region was developed in order to determine the amount of overlap between existing monitoring programs and a set of draft questions for biological monitoring

developed by the California Department of Fish and Game, with input from the Channel Islands National Marine Sanctuary, Channel Islands National Park, and NOAA's Southwest Fisheries Science Center. This summary includes the main questions that stimulate each research program. In addition, a list of study organisms and techniques is provided. Finally, a map of each monitoring program is provided to identify the locations of study sites, relative to the newly established MPAs.

Research programs are organized in this booklet according to ecological levels of classification: populations, communities, environments, and ecosystems. Many local research programs focus on the dynamics of marine populations. A variety of economically and ecologically important species are studied, such as sea urchin, abalone, sea bass, rockfish, seabirds, pinnipeds, and humpback and blue whales. Several programs monitor marine communities, defined simply as a group of different species that occupy a particular habitat. Research programs have been established to monitor communities on sandy beaches and lagoons, rocky intertidal habitats, kelp forests, subtidal rocky reefs, soft bottom habitats, and in the open ocean. Research programs that monitor community dynamics generally include surveys of the common species that occur in a particular habitat. Research on the environment includes mapping physical habitats, measuring variables such as water temperature, salinity, and oxygen content, tracking ocean currents and winds, and remote sensing. Several research programs attempt to monitor ecosystem dynamics, including both physical and biological variables.

The primary purpose of this booklet is to help the reader identify areas of overlap between existing monitoring programs and the draft questions for biological monitoring. The existing monitoring programs provide important information that will contribute to our understanding of the effects of MPAs. The contribution of existing monitoring programs, and the need for additional research, will be the primary topics of discussion at the upcoming monitoring workshop, hosted by the California Department of Fish and Game, Channel Islands National Marine Sanctuary, Channel Islands National Park, and the Bren School of Environmental Science and Management, University of California, Santa Barbara.

Map 1: State Marine Protected Area Network for the Channel Islands National Marine Sanctuary

Questions for Marine Protected Area Monitoring in the Channel Islands National Marine Sanctuary

Using prior input from the Marine Reserves Working Group, Sanctuary Advisory Council, Channel Islands National Marine Sanctuary, Channel Islands National Park, and other scientists, the California Department of Fish and Game developed a set of draft questions for monitoring of MPAs in the Sanctuary. The management agencies sought public input on the draft questions to ensure that important issues have been identified. The draft questions were distributed to scientists, fishermen, and interested members the public, who provided feedback on the relative importance of each question and other questions not included in the draft. Through this process, the agencies identified priorities and any additional questions that may be important to our marine community.

The draft questions will provide a guideline for discussions at a Marine Protected Area Monitoring Workshop in Santa Barbara, California on March 14-16, 2003. The questions are intentionally broad, in order to address a wide range of potential monitoring and research concerns. The questions address both potential effects of reserves on organisms within reserves ("Changes within Reserves") and in surrounding waters ("Spillover"). In addition, the questions address concerns about potential positive and negative impacts to habitat due to establishment of reserves ("Habitat and Ecosystem Effects"). Socioeconomic considerations are included in the draft questions; however they are not included in this summary because its primary focus is existent biological monitoring. Feedback from the public and participants in the monitoring workshop will help the Department develop a monitoring program that is effective and responsive to public concerns.

Questions for Marine Protected Area Monitoring in the Channel Islands National Marine Sanctuary

- I. Changes within Reserves Compared to Adjacent and Distant Areas
 1. Do species inside MPAs increase in size, numbers, richness/diversity and biomass relative to areas adjacent and distant from reserves?
 2. How do changes in size, numbers and biomass of animals and plants differ among reserves and how long do these changes take to occur?
 3. Does production increase after protection and is it correlated to reserve size?
- II. Spillover
 1. Do adults and young move from reserves to non-reserve areas and if so, how far?
 2. Does movement of adult fish and invertebrates from reserves increase catch outside the reserve and is this due to daily or long term movement?
 3. Does larval production in reserves contribute to an increase in populations outside reserves?
 4. If high larval production in reserves contributes to populations outside reserves, is there an increase in the number of fish available for fishing and, if so, which species?
- III. Habitat and Ecosystem Effects
 1. Do changes in fishing effort affect populations and/or habitats within and/or close to reserves?
 2. Does protection from fishing cause changes in ecosystem structure and function including potential flow of fish into or out of reserve areas?
 3. Does impaired water quality or other outside factors inhibit populations within reserves?

Questions for Marine Protected Area Monitoring in the Channel Islands National Marine Sanctuary

Habitat Categories Ranked by Questionnaire Responses

<u>General Habitat Type</u>	<u>Constituent Ranking</u>
Shallow Rock/Kelp Forest (0 - 30 m)	1
Shallow Eelgrass/Surfgrass	2
Mid-Depth Rock (31 - 100m)	3
Rocky Intertidal	4
Shallow Sand/Mud (0 - 30 m)	5
Deep Rock (>100 m)	6
Moderate Sand/Mud (31 - 100 m)	7
Sandy Beach	8
Deep Sand/Mud (>100 m)	9

Species/Species Groups Ranked by Questionnaire Responses

<u>Species/Species Group</u>	<u>Constituent Ranking</u>	<u>Species/Species Group</u>	<u>Constituent Ranking</u>
Giant Kelp	1	Yellowtail	4
Sea Urchins	1	Garibaldi	4
Nearshore Rockfish ¹	1	Ocean Whitefish	4
Shelf Rockfish ²	1	Xantus's Murrelet	4
California Sheephead	1	Cassin's Auklet	4
Sea Grasses	2	Brown Pelican	4
Abalone	2	Ashy Storm Petrels	4
Spiny Lobster	2	Sponges	5
Cabazon	2	Anemones	5
Kelp Bass	2	Cup Coral	5
Lingcod	2	Turban Snails	5
Slope Rockfish ³	2	Brittle Stars	5
White Seabass	2	Bat Stars	5
California Halibut	2	Giant-spined Stars	5
Giant Sea Bass	2	Rock Wrasse	5
California Scorpionfish	2	Opaleye	5
Sea Cucumbers	3	Blacksmith	5
Rock Scallop	3	Señorita	5
Market Squid	3	Gobies	5
Prawns	3	Harbor Seals	5
Kelp Greenling	3	Elephant Seals	5
Rock Greenling	3	Sea Lions	5
Crabs	3	Cormorants	5
Painted Greenling	3		
Gorgonians	4	<u>Additional Species Suggested by Constituents:</u>	
Hydrocoral	4	Mussels	Horn Shark
Clams	4	Owl Limpets	Leopard Shark
Kellets Whelk	4	Grunioun	Sea Otters
Sunflower Star	4	Halfmoon	Whales
Surfperches	4		

DRAFT Framework for Monitoring of State Marine Protected Areas in the Channel Islands National Marine Sanctuary

¹ Nearshore Rockfish are: black-and-yellow (*Sebastes chrysomelas*), China (*S. nebulosus*), gopher (*S. carnatus*), grass (*S. rastrelliger*), kelp (*S. atrovirens*), black (*S. melanops*), blue (*S. mystinus*), brown (*S. auriculatus*), calico (*S. dalli*), copper (*S. caurinus*), olive (*S. serranoides*), quillback (*S. maliger*), and treefish (*S. serriceps*) rockfish.

² Shelf Rockfish are: bocaccio (*Sebastes paucispinis*), bronzespotted (*S. gilli*), canary (*S. pinniger*), chameleon (*S. phillipsi*), chilipepper (*S. goodei*), cowcod (*S. levis*), dwarf-red (*S. rufinanus*), flag (*S. rubrivinctus*), freckled (*S. lentiginosus*), greenblotched (*S. rosenblatti*), greenspotted (*S. chlorostictus*), greenstriped (*S. elongatus*), halfbanded (*S. semicinctus*), honeycomb (*S. umbrosus*), Mexican (*S. macdonaldi*), pink (*S. eos*), pinkrose (*S. simulator*), pygmy (*S. wilsoni*), redstriped (*S. proriger*), rosethorn (*S. helvomaculatus*), rosy (*S. rosaceus*), silvergrey (*S. brevispinis*), speckled (*S. ovalis*), squarespot (*S. hopkinsi*), starry (*S. constellatus*), stripetail (*S. saxicola*), swordspine (*S. ensifer*), tiger (*S. nigrocinctus*), vermilion (*S. miniatus*), yelloweye (*S. ruberrimus*), and yellowtail (*S. flavidus*) rockfish.

³ Slope Rockfish are: aurora (*S. aurora*), bank (*S. rufus*), blackgill (*S. melanostomus*), darkblotched (*S. crameri*), Pacific ocean perch (*S. alutus*), redbanded (*S. babcocki*), rougheye (*S. aleutianus*), sharpchin (*S. zacentrus*), shortraker (*S. borealis*), splitnose (*S. diploproa*), yellowmouth (*S. reedi*) rockfish.

Overlap Between Research Programs and Workshop Questions

There is significant overlap between the questions developed for the workshop on biological monitoring and the questions addressed by existing research programs. Almost all of the existing research programs in the Channel Islands region consider the distribution and abundance of marine organisms (Category I, Questions 1,2). Many of the existing programs consider habitat structure and ecosystem function (Category III, Questions 1,2,3). A few programs address productivity (Category I, Question 3) and potential movement of adults and larvae (Category II, Questions 1,2,3,4). The tables on the following pages describe the overlap between research programs and workshop questions.

Category Question Number	I 1	I 2	I 3	II 1	II 2	II 3	II 4	III 1	III 2	III 3	Pg.
Category 1: Populations											
Marine Plants											
Aerial Monitoring of Kelp Canopy	X	X						X	X		17
Eelgrass (<i>Zostera</i>) Surveys	X	X						X	X		19
Marine Invertebrates											
Anacapa Urchin Reef Surveys	X	X						X	X		22
Studies of White Abalone	X	X						X	X		25
ROV Surveys of Squid	X	X	X					X			27
Aerial Surveys of Squid											30
Marine Fish											
Acoustic Telemetry				X							32
Giant Sea Bass Monitoring	X	X						X			35
Nearshore Surveys	X	X						X	X	X	38
Midwater Surveys	X	X								X	41
Deepwater Surveys	X	X						X	X	X	44
Marine Birds											
Cormorant Monitoring	X	X						X			47
Xantus's Murrelet Monitoring 1	X	X						X			49
Xantus's Murrelet Monitoring 2	X	X						X			52
Pelican and Cormorant Studies	X	X	X	X				X	X		55
Cassin's Auklet Studies	X	X		X				X		X	58
Ashy Storm-Petrel Studies	X	X						X			61
Seabird Population Dynamics	X	X	X					X			64

Overlap Between Research Programs and Workshop Questions

Category Question Number	I 1	I 2	I 3	II 1	II 2	II 3	II 4	III 1	III 2	III 3	Pg.
Category 1: Populations											
Marine Mammals											
Pinniped Population Studies	X	X	X					X	X	X	66
Aerial Monitoring of Pinnipeds	X	X						X			69
Sea Lion Diet Studies	X	X						X	X		72
Harbor Seal Annual Census	X	X						X	X		74
Humpback and Blue Whales								X	X		76
Category 2: Communities											
Sand Beach Monitoring	X	X	X			X		X	X	X	78
Rocky Intertidal Monitoring	X	X	X			X		X	X	X	81
Kelp Forest Monitoring	X	X	X			X		X	X	X	85
Subtidal Monitoring	X	X						X	X		90
REEF Monitoring	X	X							X		95
Nearshore Fishes	X	X		X				X	X	X	99
PISCO	X	X	X	X	X	X	X	X	X	X	102
Wind to Whales											110
Sanctuary Naturalist Corps	X							X	X		111
Collaborative Marine Research											114
SAMSAP	X	X						X			116
Category 3: Environment											
CODAR				X							118
Remote Sensing								X			121
Side Scan Sonar Mapping								X	X		123
Category 4: Ecosystems											
Bight '98	X	X								X	126
Plumes and Blooms	X	X								X	129
LTER	X	X						X	X	X	133
CalCOFI	X	X	X			X	X	X	X	X	138
MEERP	X	X	X		X	X	X	X	X	X	143

Study Species in Existing Monitoring Programs

Taxa	Total	Plants	Inverts	Fish	Birds	Mammals
Category 1: Populations						
Marine Plants						
Aerial Kelp Monitoring	1	1				
Eelgrass Surveys	Tens	2	x	x		
Marine Invertebrates						
Urchin Reef Surveys	Tens	x	x	x		
White Abalone Studies	Video		1			
ROV Surveys of Squid	1		1			
Aerial Surveys of Squid	1		1			
Marine Fish						
Acoustic Telemetry	4			4		
Giant Sea Bass Monitoring	1			1		
Nearshore Surveys	x	x	x	x		
Midwater Surveys	x		x	x		
Deepwater Surveys	x	x	x	x		
Marine Birds						
Cormorant Monitoring	1				1	
Xantus's Murrelet Monitoring 1	1				1	
Xantus's Murrelet Monitoring 2	1				1	
Pelican and Cormorant Studies	4				4	
Cassin's Auklet Studies	1				1	
Ashy Storm-Petrel Studies	1				1	
Seabird Population Dynamics	9				9	
Marine Mammals						
Pinniped Population Studies	5					5
Aerial Monitoring of Pinnipeds	5					5
Sea Lion Diet Studies	1					1
Harbor Seal Annual Census	1					1
Humpback and Blue Whales	all					2

Study Species in Existing Monitoring Programs

Taxa	Total	Plants	Inverts	Fish	Birds	Mammals
Category 2: Communities						
Sand Beach Monitoring	varies					
Rocky Intertidal Monitoring	varies					
Kelp Forest Monitoring	66	13	37	16		
Subtidal Monitoring	26	1	25			
REEF Monitoring	111			111		
Nearshore Fishes	x			all		
PISCO	104		30	74		
Wind to Whales	x		all		all	all
Sanctuary Naturalist Corps	20					28
Collaborative Marine Research	13			13		
SAMSAP	all					2
Category 3: Environment						
CODAR	N/A					
Remote Sensing	N/A					
Side Scan Sonar Mapping	N/A		x			
Category 4: Ecosystems						
Bight '98	N/A					
Plumes and Blooms	N/A					
LTER	150 +	x	x	x		
CalCOFI	??	?	?	301		
MEERP	x			all		

Number of Monitoring Sites in Marine Protected Areas

Marine Protected Area	Total	Inside	Rich Rk	Harris Pt	Judith Rk	South Pt	Carr Pt	Skunk Pt	Paint Cave	Gull Island	Scorp Rk	N Ani I SMCA	N Ani I SMR	SB Island
Category 1: Populations														
Marine Plants														
Aerial Kelp Monitoring		x	x	x	x	x	x	x	x	x	x	x	x	x
Eelgrass Surveys	12	4					1	1			1		1	
Marine Invertebrates														
Urchin Reef Surveys	1	0												
White Abalone Studies	undisclosed													
ROV Surveys of Squid		x				x	x	x	x	x	x	x	x	x
Aerial Surveys of Squid		x				x	x	x	x	x	x	x	x	x
Marine Fish														
Acoustic Telemetry		x									x	x	x	x
Giant Sea Bass													x	
Nearshore Surveys	21	3									1	1	1	
Midwater Surveys		9				4				2	2		1	
Deepwater Surveys		11	1							1				9
Marine Birds														
Cormorant Monitoring		x	x	x	x	x	x	x	x	x	x	x	x	x
Xantus's Murrelet 1	4	4										1	2	1
Xantus's Murrelet 2	1	1												1
Pelicans/Cormorants	4	4										1	2	1
Cassin's Auklet Studies	2	2		1							1			
Ashy Storm-Petrel	5	3							1		2			
Seabird Populations		x	x	x	x	x	x	x	x	x	x	x	x	x

Number of Monitoring Sites in Marine Protected Areas

Marine Protected Areas	Total	Inside	Rich Rk	Harris Pt	Judith Rk	South Pt	Carr Pt	Skunk Pt	Paint Cave	Gull Island	Scorp Rk	N Ani I SMCA	N Ani I SMR	SB Island
Marine Mammals														
Pinniped Populations		X	X	X	X									
Aerial Pinniped Studies		X	X	X	X	X	X	X	X	X	X	X	X	X
Sea Lion Diet Studies														
Harbor Seal Census														
Humpback/Blue Whales		X	X	X			X		X		X			
Category 2: Communities														
Sand Beach Monitoring	12	4					1	3						
Rocky Intertidal	22	6		2							1	1	2	2
Kelp Forest Monitoring	16	6		1						1	1		2	1
Subtidal Monitoring	1	0												
REEF Monitoring	77	16		4		1		2		1	3	2	2	2
Nearshore Fishes	8	1									1			
PISCO	32	7		1							1		4	1
Wind to Whales														
Naturalist Corps		X	X	X			X		X		X			
Collaborative Research		3										1	2	
SAMSAP		X	X	X	X	X	X	X	X	X	X	X	X	X
Category 3: Environment														
CODAR	2	0												
Remote Sensing		X	X	X	X	X	X	X	X	X	X	X	X	X
Side Scan Sonar		X		X	X					X	X	X	X	
Category 4: Ecosystems														
Bight '98	51	11		1	1					1	3	1	2	2
Plumes and Blooms	8	0												
LTER	26 reef 32 river	0												
CalCOFI	6	1				1								
MEERP	2	0												

Resources Available for Existing Monitoring Programs

Resources	Staff	Boat	Plane	Sub/ ROV	Annual Cost
Category 1: Populations					
Marine Plants					
Aerial Kelp Monitoring	2 staff; once per quarter		X		\$2,500
Eelgrass Surveys	2 staff and 4 volunteers for 5 days	X			\$10,000
Marine Invertebrates					
Urchin Reef Surveys	2 staff and 4 volunteers for 5 days	X			\$10,000
White Abalone Studies	2-3 staff plus volunteers	X		X	
ROV Surveys of Squid	4 staff	X		X	
Aerial Surveys of Squid	2 staff		X		
Marine Fish					
Acoustic Telemetry	4 staff: 1 full time 3 part time	X	X	X	\$260,000
Giant Sea Bass Monitoring	2 staff	X			
Nearshore Surveys	5 staff during monitoring	X			>\$100,000
Midwater Surveys	4 staff 1 ship captain	X			\$20,000
Deepwater Surveys	4 staff	X		X	\$200,000
Marine Birds					
Cormorant Monitoring		X			
Xantus's Murrelet Monitoring 1	4 staff	X			
Xantus's Murrelet Monitoring 2	2 staff	X			
Pelican and Cormorant Studies	2 staff for 150 person days	X	X		\$150,000
Cassin's Auklet Studies	None available				*\$175,000
Ashy Storm-Petrel Studies	4-6 staff for 3 days	X			Not available
Seabird Population Dynamics	1 staff for 7-8 mo/yr	X			

*Funding not currently available.

Resources Available for Existing Monitoring Programs

Resources	Staff	Boat	Plane	Sub/ ROV	Annual Cost
Marine Mammals					
Pinniped Population Studies	4 staff for 400 person days per year	X			>\$100,000
Aerial Monitoring of Pinnipeds	1 staff at 70% time; +2 staff during surveys		X		\$10,000 to \$40,000
Sea Lion Diet Studies	1 staff at 30% time; others as necessary	X			\$11,500 to \$17,000
Harbor Seal Annual Census	3 staff during May, Jun, Jul		X		\$10,000 to \$20,000
Humpback and Blue Whales	2 part time staff	X			\$100,000
Category 2: Communities					
Sand Beach Monitoring	None available	X			None available
Rocky Intertidal Monitoring	2 half time	X			\$60,000
Kelp Forest Monitoring	1 full time; 3* half time	X			\$183,000
Subtidal Monitoring	2 staff during surveys	X			\$7,500
REEF Monitoring	4 staff, full time and volunteers				\$550,000 for all sites
Nearshore Fishes	20 staff	X			Internal
PISCO	36 staff	X			~\$200,000
Wind to Whales	None available				None available
Sanctuary Naturalist Corps	90 volunteers and 1 intern	X			Internal
Collaborative Marine Research					
SAMSAP	2 staff twice each week		X		\$50,000
Category 3: Environment					
CODAR	4 staff	X			>\$200,000
Remote Sensing	Variable		X		Variable
Side Scan Sonar Mapping	2 staff	X			

*Funding not currently available.

Resources Available for Existing Monitoring Programs

Resources	Staff	Boat	Plane	Sub/ ROV	Annual Cost
Category 4: Ecosystems					
Bight '98	2 staff	X	X		\$20,000
Plumes and Blooms	2 staff full time, 1 grad student				\$200,000
LTER	Variable	X			Variable
CalCOFI	4 staff	X			\$1,000,000
MEERP	3 staff, grad students, and technicians	X			\$200,000- \$490,000

*Funding not currently available.

Category 1: Populations (Single species or species complex)

Populations: Marine Plants

Research Program: Aerial Monitoring of Kelp Canopy

Agency or Institution: Channel Islands National Marine Sanctuary

Contact: Ben Waltenberger

Email: ben.waltenberger@noaa.gov

Address: Channel Islands National Marine Sanctuary, 113 Harbor Way, Suite 150, Santa Barbara, CA 93109

Phone: 805-884-1461

Fax: 831-568-1582

Objectives: Ancillary monitoring of kelp canopy change

Questions: Where is the kelp?

Data Collected Since: August 1999

Frequency of Data Collection: Quarterly

Data Type: GIS point files of canopy location and thickness.

Availability of Data:

Data is stored in GIS point files. Data is available to the public.

Techniques:

Simple point file of location and extent (heavy or light kelp growth)

Number of Species Studied: 1

Species List: Giant Kelp, *Macrocystis pyrifera*

Number of Sites: Entire shoreline of the Channel Islands National Marine Sanctuary

Location of Sites:

Around islands within the Channel Islands National Marine Sanctuary

Research Program: Aerial Monitoring of Kelp Canopy

Staff Available for Monitoring:

Two staff members are provided once a quarter.

Resources Available for Monitoring:

Lake Seawolf Aircraft

Annual Funding Level and Source:

\$2,500/year from National Oceanic and Atmospheric Administration and National Ocean Service

Research Program: Eelgrass (*Zostera*) Surveys

Agency or Institution: University of California, Santa Barbara

Contact: Jack Engle

Email: j_engle@lifesci.ucsb.edu

Address: Marine Science Institute, University of California, Santa Barbara, CA, 93106

Phone: 805-893-8547

Fax: 805-893-8062

Objectives:

- To determine location, extent, and depth limits of eelgrass beds at the Channel Islands.
- To characterize the assemblage of plants, invertebrates, and fishes associated with the eelgrass beds.

Questions:

- How do eelgrass beds differ among the islands?
- Is the eelgrass *Zostera marina* or *Z. asiatica*?
- How do the eelgrass beds change through time?
- How are new eelgrass beds established?

Data Collected Since: 1992

Frequency of Data Collection:

Data is collected annually at 1 site since 1992; data is collected annually at 6 sites from 1994-97; data is collected occasionally at other sites from 1994-2002.

Data Type:

Zostera bed extent maps, *Zostera* morphometrics, *Zostera* density, *Zostera* assemblage plant/invertebrate density/cover, fish density.

Availability of Data:

Data stored in Excel spreadsheets. Most data can be made public.

Research Program: Eelgrass (*Zostera*) Surveys

Techniques:

Sampling occurs within 30 25 m² quadrats and 1.5 m wide band transects along a 60 m transect. Fishes are counted (4 replicates) within a 2 m wide by 3 m high corridor centered on the transect.

Number of Species Studied: Tens of species.

Species List: All obviously identifiable species. Tabular lists produced.

Number of Sites: 12

Location of Sites: Anacapa: (N Frenchys, Cathedral Cove, EW Cat Rock); Santa Cruz: (Scorpion, Canada del Agua, Prisoners, Forney's, Yellow Banks, Smugglers), Santa Rosa (Bechers, East End, Johnson's Lee).

Staff Available for Monitoring: 2 staff plus 4 volunteers during a period of about 5 field days per year.

Resources Available for Monitoring: 47 ft UCSN vessel *Cormorant*

Annual Funding Level and Source:

Approximately \$10,000 per year from Tatman Foundation

Map 2: Eelgrass (*Zostera*) Surveys

Populations: Marine Invertebrates

Research Program: Anacapa Urchin Reef Surveys

Agency or Institution: University of California, Santa Barbara

Contact: Jack Engle

Email: j_engle@lifesci.ucsb.edu

Address: Marine Science Institute, University of California, Santa Barbara, CA, 93106

Phone: 805-893-8547

Fax: 805-893-8062

Objectives: To determine changes in community composition through time in an urchin-dominated subtidal reef at Survey Rock, Anacapa Island.

Questions:

- What tips the balance between kelp- and urchin-dominated reefs?
- How do urchin-dominated communities change through time?

Data Collected Since: 1981

Frequency of Data Collection: Annual

Data Type:

- Plant/invertebrate density/cover of the reef assemblage
- Fish abundances (occasional)
- Water temperature (loggers)

In addition, reconnaissance data is available on the distribution and relative abundance of marine species around the islands.

Availability of Data: Data stored in Excel spreadsheets. Some data are published and some can be made public.

Techniques: Surveys are conducted within thirty (30) 0.25 m² quadrats and 1.5 m wide band transects along three (3) 60 m transects stratified by depth. On occasion, random quadrats are used.

Number of Species Studied: Tens of species.

Species List: All obviously identifiable species. Tabular lists produced.

Research Program: Anacapa Urchin Reef Surveys

Number of Sites: 1

Location of Sites: Survey Rock, Anacapa Island

Staff Available for Monitoring: 2 staff and 4 volunteers for a period of approximately 5 field days per year

Resources Available for Monitoring: 47 ft UCSN vessel Cormorant

Annual Funding Level and Source:

Approximately \$10,000 from Tatman Foundation

Map 3: Anacapa Urchin Reef Surveys

Research Program: DFG and CINP Studies of White Abalone

Agency or Institution: California Department of Fish and Game

Contact: Peter L. Haaker

Email: phaaker@dfg.ca.gov

Address: 4665 Lampson Ave, Suite C, Los Alamitos, CA 90720

Phone: 562-342-7181

FAX: 562-342-7139

Objectives:

- To assess populations of white abalone at the California Channel Islands
- To develop a recovery plan for white abalone
- To rebuild white abalone populations in former habitats

Questions:

- Do significant populations of white abalone remain?
- What areas constituted white abalone habitat, and how extensive was the historical distribution?
- Would human intervention be useful in rebuilding stocks of white abalone?

Data Collected Since: mid-1980s

Frequency of Data Collection: Depends on available ship time

Data type: Benthic submarine and ROV surveys acquire video. SCUBA transect surveys are also conducted.

Availability of Data: Much of the data have been published and are readily available. Data are stored at several agencies, but will be acquired and synthesized by the White Abalone Recovery Team in the coming years.

Techniques: SCUBA, submarine, and ROV surveys have located over 200 white abalones. Benthic surveys are conducted with GPS and a video camera. In the future, habitat maps of the region will help determine suitable habitat for white abalone and stratified searches may be accomplished.

Research Program: DFG and CINP Studies of White Abalone

Number of Species Studied: White abalone is the target, but the entire benthic community is recorded on video. Data for other species may be obtained via post processing of video.

Number of Sites: The intent of the program is to cover as much area as possible.

Location of Sites: Exact location of completed work is sensitive, as it reveals the location of individual and groups of white abalone. Work is continuing at Santa Cruz, Anacapa, Santa Barbara, Santa Catalina, San Clemente Islands, and the offshore banks.

Staff Available for Monitoring: Staff involved depends on the type of monitoring. Within the Department of Fish and Game, 2 to 3 staff are available. We also collaborate with staff from Channel Islands National Park, Channel Islands National Marine Sanctuary, National Marine Fisheries Service, and local universities.

Resources Available for Monitoring: Cooperative agencies have provided ROV and boat time. R/V Mako is often used. Occasionally, grants have supported the use of submarines.

Annual Funding Level and Source: The California Department of Fish and Game supports staff salaries. The Department funds white abalone (and other species) through the Near Shore Invertebrate Project. Submersible and ROV surveys have been funded with S-K and NFWF grants. Much research is conducted with resources provided by other agencies.

Research Program: ROV Surveys of Market Squid

Agency or Institution: Market Squid Investigations Unit, California Department of Fish and Game

Contact: Annette Henry

Email: annette.henry@noaa.gov

Address: 8604 La Jolla Shores Drive, La Jolla, CA 92037

Phone: 858-546-5680

Fax: 858-546-7116

Objectives:

- To characterize market squid spawning habitat using a remotely operated vehicle.
- To attempt to use market squid eggs observed as an index of abundance for population estimates.

Questions:

- What substrate, depth and temperature do market squid require for egg deposition?
- What is the rate of egg deposition?
- What is the life expectancy of spawning females?

Data Collected Since: December 1999

Frequency of Data Collection: Annually

Data Type:

Digital videotapes

ASCII text files with temperature and depth

Availability of Data:

Most of the data are stored in Excel files.

Video tapes will be analyzed by NOAA.

Techniques:

Remotely operated vehicle (ROV) is used to collect data

Research Program: ROV Surveys of Market Squid

Number of Species Studied: 1

Species List: Market Squid, *Loligo opalescens*

Number of Sites: many

Location of Sites:

Primarily inshore up to depths of 100 m around Santa Rosa, Santa Barbara, Anacapa, Santa Cruz and Catalina islands

Staff Available for Monitoring:

Corey Kong, Travis Tanaka, Annette Henry, Valerie Taylor

Resources Available for Monitoring:

Use of National Marine Fishery Service's ROV to collect data

Annual Funding Level and Source:

This project is a cooperative effort between National Marine Fisheries Service and California Department of Fish and Game.

Map 4: ROV Surveys of Market Squid

Research Program: Aerial Surveys of Market Squid

Agency or Institution: Market Squid Investigations Unit, California Department of Fish and Game

Contact: Annette Henry

Email: annette.henry@noaa.gov

Address: 8604 La Jolla Shores Drive, La Jolla, CA 92037

Phone: 858-546-5680

Fax: 858-546-7116

Objectives:

- To groundtruth satellite images of fishing activity at the Channel Islands with observed fishing activity.
- To validate activity recorded on market squid vessel and light boat fishing logs with observed fishing activities.

Questions:

- Can fishing activity be accurately recorded with satellite telemetry?
- How valid are logbook records for estimating market squid fishing effort?

Data Collected Since: Satellite images processed since April 1992; data on fishing activity collected since June 2000.

Frequency of Data Collection: 1-2 times per month

Data Type:

Observer records (spreadsheet)

Satellite image files are stored at National Geophysics Data Center (NGDC) in Boulder, CO, and converted for use by the Department of Fish and Game.

Availability of Data:

Satellite images from April 1992 through June 2001 are available upon request.

Techniques:

Satellite images used to estimate fishing effort

Research Program: Aerial Surveys of Market Squid

Number of Species Studied: 1

Species List: Market Squid, *Loligo opalescens*

Number of Sites: many

Location of Sites:

Primarily inshore up to depths of 100 m around Santa Rosa, Santa Barbara, Anacapa, Santa Cruz, San Miguel and Catalina islands (See Map 4).

Staff Available for Monitoring:

Annette Henry, Valerie Taylor

Resources Available for Monitoring:

National Geophysics Data Center archived satellite images
California Department of Fish and Game air services, Hemet

Annual Funding Level and Source:

This project is a cooperative effort between National Geophysics Data Center, National Marine Fisheries Service and California Department of Fish and Game.

Populations: Marine Fish

Research Program: Monitoring via Acoustic Telemetry

Agency or Institution: Pflieger Institute of Environmental Research (PIER)

Contact: Michael L. Domeier, Ph.D.

Email: domeierml@cs.com

Address: 901-B Pier View Way, Oceanside, CA 92054

Phone: 760-721-1440

Fax: 760-721-1475

Objectives: To identify habitat preferences, home range and seasonal movement patterns of giant sea bass and white seabass.

Questions:

- What habitats are occupied by giant sea bass and white seabass?
- What are the home range sizes of giant sea bass and white seabass?
- How much and where do giant sea bass and white seabass move during the year?

Data Collected Since: July 2000

Frequency of Data Collection: Recorded in real time, collected quarterly

Data Type: Spatial positioning and swimming depth of individual tagged fish

Availability of Data:

What format is used to store the data? Currently in Excel, soon moved to Access
Are the data available to the public? No.

Techniques:

Data logging hydrophones are placed in an overlapping sensor array that completely covers Anacapa and Santa Barbara Islands from the shore to a distance of 2 km offshore. Santa Catalina and Santa Cruz Islands do not have total coverage but do have some strategically located stations.

Number of Species Studied: Four

Species List:

Giant sea bass and white seabass (PIER); sheephead and cabezon (PISCO)

Research Program: Monitoring via Acoustic Telemetry

Location of Sites: See Map 5.

Staff Available for Monitoring: 4 staff members work on this project (1 full time and 3 part time)

Resources Available for Monitoring:

50 ft research vessel *Malolo*, equipped with sonar, color fathometer, WAAS and DGPS, plotter, radar, bathymetry mapping system, dive compressor and live fish holding capability; 200 lb ROV with lights, 2 cameras and manipulator; digital U/W video camera; Cessna 182.

Annual Funding Level and Source: Approximately \$260,000 per year

Map 5: Monitoring Via Acoustic Telemetry

Research Program: Giant Sea Bass Monitoring at Anacapa Island

Contact: Kathy deWet-Oleson

Email: kdocean@earthlink.net

Address: 5286 Shiloh Way, Ventura, CA 93003

Phone: 805-650-1834

Fax: 805-650-5974

Objectives: To identify habitat preferences, home range, and behavioral patterns of giant sea bass.

Questions:

- Where do giant sea bass aggregate?
- What habitats are occupied by giant sea bass?
- What are the home range sizes of giant sea bass?
- How much and where do giant sea bass move during the year?
- What are the behavioral patterns of giant sea bass?

Data Collected Since: May 1997

Frequency of Data Collection:

1997-2000: 2 dive trips per month year round, with a minimum of 2 dives each month both on and off the original site. From May to September, when more sightings occur, the diving effort is increased to as many as 24 dives per month. 2000-2002: random dives were conducted less frequently from May to September to permit more behavioral observations and photo identification.

Data Type:

Notes or video are used to document behaviors, including color patterns, pattern change, utilization of the reef and the water column, swimming activity, cleaning activity, boom sounding, and interactions both among the species and with other species. Notes on some basic oceanographic information, such as temperature, visibility, current direction and intensity are also recorded.

Availability of Data:

What format is used to store the data?
Are the data available to the public?

Research Program: Giant Sea Bass Monitoring at Anacapa Island

Techniques: Video taped observations

Number of Species Studied: 1

Species List: Giant sea bass, *Stereolepis gigas*

Location of Sites: Anacapa Island

Staff Available for Monitoring: 2 SCUBA divers

Resources Available for Monitoring: Boat

Annual Funding Level and Source: Internal funding only

Map 6: Giant Sea Bass Monitoring at Anacapa Island

Research Program: Nearshore SCUBA Surveys

Agency or Institution: University of California, Santa Barbara

Contact: Donna Schroeder

Email: schroed@lifesci.ucsb.edu

Address: Marine Science Institute, University of California, Santa Barbara, CA 93106

Phone: 805-893-3835

Fax: 805-893-8062

Questions:

- What are the species composition, size, density, and population dynamics of fish in the shallow subtidal zone?
- What are the species composition, density, and population dynamics of macroinvertebrates in the shallow subtidal zone?
- What are the species composition, size, and density of macroalgae?
- What percentage of substrate is covered with fouling organisms?
- What are the depth, substrate type, and relief height?
- What are the water temperature and salinity?

Data Collected Since: 1995

Frequency of Data Collection: Minimum of 3 times per year in summer and fall

Number of Sites: 21 sites in the Channel Islands region

Location of Sites: Along the coast of southern California and Baja California; around Anacapa, Santa Cruz, Santa Catalina, San Clemente, and San Nicholas Islands.

Techniques: SCUBA surveys

Research Program: Nearshore SCUBA Surveys

Data Type:

Fish	Species composition Size Density Juvenile recruitment Population dynamics
Macroinvertebrates	Species composition Density Population dynamics
Macroalgae	Species composition Size Density Population dynamics
Fouling Organisms	Estimation and dynamics of percent cover of substrate
Physical Factors	Substrate type Relief height Depth Water Temperature Salinity

Availability of Data:

Data are stored in Excel and Access.

Data are not available to the public.

Species List:

Fish

Macroinvertebrates

Macroalgae

Fouling organisms

Staff Available for Monitoring: 5 full-time staff during monitoring

Resources Available for Monitoring:

Small to large dive vessels and trained divers.

Annual Funding Level and Source: >\$100,000 per year from United States Geological Survey (USGS) and CARE.

Map 7: Nearshore SCUBA Surveys

Research Program: Midwater Trawl Surveys

Agency or Institution: University of California, Santa Barbara

Contact: Mary Nishimoto

Email: nisimot@lifesci.ucsb.edu

Address: Marine Science Institute, University of California, Santa Barbara, CA 93106

Phone: 805-893-3835

Fax: 805-893-8062

Questions:

- What is the species composition, size, density, and population dynamics of fish?
- What is the species composition, density, and population dynamics of pelagic macroinvertebrates?
- What are the predominant current direction and speed?
- What are the water temperature and salinity?

Data Collected Since: 1995-2000

Frequency of Data Collection: Annually, 10 day surveys in June

Data Type:

Fish	Species composition Size Density Population dynamics
Pelagic macroinvertebrates	Species composition Density Population dynamics
Physical Factors	Depth Water Temperature Salinity Current speed and direction

Availability of Data:

Data are stored in Excel. Data are not available to public at present.

Research Program: Midwater Trawl Surveys

Techniques: Midwater trawl surveys

Number of Species Studied:

Entire midwater assemblages with a focus on rockfish

Species List:

Fish

Pelagic macroinvertebrates

Number of Sites: Approximately 40 sites are surveyed each year. Survey locations change each year.

Location of Sites: Survey locations change from year to year. Surveys are conducted in the Santa Barbara Channel and around the northern Channel Islands. Surveys are conducted as far north as Point Purisma and as far south as Point Mugu.

Staff Available for Monitoring: Minimum 4 persons and ship captain

Resources Available for Monitoring: Chartered commercial trawler

Annual Funding Level and Source: Vessel costs approximately \$20,000 per year. Funds are provided by the United States Geological Surveys (USGS) and CARE.

Map 8: Midwater Trawl Surveys

Research Program: Deepwater Submersible Surveys

Agency or Institution: University of California, Santa Barbara

Contact: Dr. Milton Love

Email: love@lifesci.ucsb.edu

Address: Marine Science Institute, University of California, Santa Barbara, CA 93106

Phone: 805-893-2935

Fax: 805-893-8062

Questions:

- What are the species composition, size, density, and population dynamics of deepwater fish?
- What are the species composition, density, and population dynamics of benthic macroinvertebrates?
- Are macroalgae present or absent?
- What percentage of substrate is covered with fouling organisms?
- What are the depth, substrate type, and relief height?
- What are the water temperature and salinity?

Data Collected Since: 1995

Frequency of Data Collection: Annual survey including 40-50 dives

Number of Sites: 120 sites surveyed in 2002

Location of Sites: Throughout the southern California Bight, particularly in the Santa Barbara Channel and Santa Monica Bay, and around the Channel Islands, the Footprint, offshore oil platforms, 43 fathom spot, Cherry, Cortez and Tanner Banks, and 14 Mile Bank.

Techniques: Deepwater submersible surveys

Research Program: Deepwater Submersible Surveys

Data Type:

Fish	Species composition Size Density Population dynamics
Benthic macroinvertebrates	Species composition Density Population dynamics
Macroalgae	Presence or absence
Fouling Organisms	Percent cover of substrate
Physical Factors	Substrate type Relief height Depth Water temperature Salinity

Availability of Data: Occasionally on request

Number of Species Studied: Approximately 100 species, with a focus on deepwater rockfish

Species List:

Fish
Benthic macroinvertebrates
Macroalgae
Fouling organisms

Staff Available for Monitoring: 4 persons

Resources Available for Monitoring: All equipment leased

Annual Funding Level and Source:

\$200,000 per year from United States Geological Survey (USGS) and CARE

Map 9: Deepwater Submersible Surveys

Populations: Marine Birds

Research Program: Population Monitoring of Cormorants

Agency or Institution: Humboldt State University

Contact: Harry Carter

Email: hrc5@humboldt.edu

Address: PO Box 1482, Davis, CA 95717

Phone: 707-592-7254

Fax: 707-826-3943

Objectives: To monitor population trends and determine population size of the Double-crested Cormorant in the Channel Islands.

Questions:

- What is the status of the cormorant population in the Channel Islands?

Data Collected Since: 1991- 2003
(This is the last year of funding for this project.)

Frequency of Data Collected:
Three times a year, one time in each of the following months: March, April, May.

Data Type: Aerial photographs for a period of over 10 years

Availability of Data: Unsure when data will be available

Techniques: Aerial photography

Number of Species Studied: 2

Species List:
Double-crested Cormorant
Brandt's Cormorant

Location of Sites: All Channel Islands

Staff Available for Monitoring: 3 personnel needed for photography

Research Program: Population Monitoring of Cormorants

Resources Available for Monitoring:

Zodiacs, outboard engine, government equipment

Annual Funding Level and Source:

\$15,000 per year from State Fish and Wildlife Service

Fish and Game provide flight support.

US Navy provides additional support.

Research Program: Population study of Xantus's Murrelet after rat eradication on Anacapa Island

Agency or Institution: Humboldt State University

Contact: Harry Carter

Email: hrc5@humboldt.edu

Address: PO Box 1482, Davis, CA 95717

Phone: 707-592-7254

Fax: 707-826-3943

Objectives: To measure expected increase in population size of Xantus's Murrelet after eradication of rats on Anacapa Island.

Questions:

- How is the population of the Xantus's Murrelet affected by the eradication of rats on Anacapa Island?
- How does the population of Xantus's Murrelet on Anacapa Island compare with population on Santa Barbara Island?

Data Collected Since: 2000

Frequency of Data Collected:

5 days a week during field season (late March through mid-June)

Data Type:

Anacapa Island:

Nest monitoring

Radar monitoring (count birds flying in and out of cliffs at night)

Spotlight Surveys (count birds on nearshore waters at night)

Santa Barbara Island:

Radar Monitoring

Spotlight Surveys

Availability of Data:

Annual reports prepared for the American Trader Trustees Council are available for 2001 and 2002. Subsequent report will be available in January 2004.

Research Program: Population study of Xantus's Murrelet after rat eradication on Anacapa Island

Techniques:

- Nest monitoring
- Radar monitoring (count birds flying in and out of cliffs at night)
- Spotlight Surveys (count birds on nearshore waters at night)

Number of Species Studied: 1

Species List: Xantus's Murrelet, *Synthliboramphus hypoleucus*

Location Of Sites:

Anacapa:

- Middle and west island in sea caves (nest monitoring)
- South side (radar monitoring)
- Around the island (spotlight surveys)

Santa Barbara:

- Landing cove area (radar surveys)
- Around island (spotlight surveys)

Staff Available for Monitoring:

4 full time field staff

Collaborators:

- Hamer Environmentals
- Channel Island Sanctuary
- California Institute of Environmental Studies (Davis)
- Channel Island National Park

Resources Available for Monitoring: Zodiacs, outboard engine, Sanctuary boats

Annual Funding Level and Source: American Traders Trustees Council which includes the Department of Fish and Game, Fish and Wildlife Service, and NOAA's Channel Islands National Marine Sanctuary (closely affiliated with the Channel Islands National Park)

Map 10: Population Study of Xantus's Murrelets

Research Program: Population trends of the Xantus's Murrelet on Santa Barbara Island

Agency or Institution: Humboldt State University

Contact: Harry Carter

Email: hrc5@humboldt.edu

Address: PO Box 1482, Davis, CA 95717

Phone: 707-592-7254

Fax: 707-826-3943

Objectives: To confirm continuous Xantus's Murrelet population decline since 1970's

Questions:

- How is the population of the Xantus's Murrelet affected by the eradication of rats on Anacapa Island?
- How does the population of Xantus's Murrelet on Anacapa Island compare with population on Santa Barbara Island?

Data Collected Since: 2001 (This is the last year this project will be carried out independent researchers. The Channel Islands National Park may adopt this project as part of routine monitoring.)

Frequency of Data Collected: Twice a year

Data Type: Nest monitoring

Availability of Data: Annual report will be released in January 2004.

Techniques: Recheck nests documented in the past year.

Number of Species Studied: 1

Species List: Xantus's Murrelet, *Synthliboramphus hypoleucus*

Location of Sites:

Santa Barbara Island between Ranger Station and Arch Point Area

Research Program: Population trends of the Xantus's Murrelet on Santa Barbara Island

Staff Available for Monitoring:

2 full time staff

Collaborators:

Channel Islands National Park

Point Reyes Bird Observatory

USGS

Resources Available for Monitoring: Zodiacs, outboard engine, Channel Islands National Marine Sanctuary boats

Annual Funding Level and Source:

Funding from California Fish and Game and USFS

Map 11: Population Trends of Xantus's Murrelet on Santa Barbara Island

Research Program: Brown Pelican and Cormorant Population Dynamics

Agency or Institution: California Institute of Environmental Studies and University of California, Davis

Contact: Dr. Frank Gress

Email: fgress@pacbell.net

Address: California Institute of Environmental Studies, 3408 Whaler Avenue, Davis, CA 95616 and Department of Wildlife, Fish, and Conservation Biology, University of California, Davis, CA 95616

Phone: 530-756-6944

Fax: 530-758-2939

Objectives:

- To estimate annual nesting effort and productivity (breeding success) of Brown Pelican, Brandt's Cormorant, Double-crested Cormorant, and Pelagic Cormorant on Anacapa Island.
- To assess contaminant levels and the potential impact of contaminants on breeding success (prior to 1993).

Questions:

- How many nests are built each year?
- How many young produced per nest?
- How many chicks fledged per nesting attempt?
- What are the composition, biomass and numbers of different prey species in the diet of young birds?
- Are the levels of contaminants increasing?
- Where do birds go? Do birds return to natal breeding grounds?

Data Collected Since: Every year since 1970 (except 1995)

Frequency of Data Collection: Every year; generally 4-7 trips for 7-10 days for each month during the breeding season.

Availability of Data:

What format is used to store the data? Excel

Are the data available to the public? No

Research Program: Brown Pelican and Cormorant Population Dynamics

Techniques:

Observation on the island and from boats during breeding season. Observation alone documents approximately 75% of the nests each year. Brown Pelicans and Double-crested Cormorants breed primarily on West Anacapa Island whereas Pelagic and Brandt's cormorants breed on all of the Anacapa Islands. During the breeding season, individual nests are marked to follow nesting success and later in the breeding season some chicks are banded to track dispersal of young. Some birds are marked with radio transmitters and tracked using terrestrial and aerial telemetry. Aerial surveys of Santa Barbara and Anacapa Islands are conducted to detect breeding of California Brown Pelicans and Double Crested Cormorants. Occasionally, eggs are collected to test for contaminant levels.

Number of Species Studied: 4

Species List:

California Brown Pelican
Brandt's Cormorant
Double-crested Cormorant
Pelagic Cormorant

Number of Sites: 2

Location of Sites: Anacapa and Santa Barbara Islands

Staff Available for Monitoring:

2 staff conduct an average of six (6) 7-10 day trips to the islands and 14 days of aerial surveys each year for a total of approximately 150 person days in the field

Resources Available for Monitoring:

Two (2) 13-ft *Zodiacs* for travel around the islands, California Department of Fish and Game aircraft from Sacramento for aerial surveys (14 days/year)

Annual Funding Level and Source:

Variable: \$45,000 for observation, \$65,000 for diet studies, \$15,000 for aerial monitoring, \$25,000 for contaminant monitoring. Funding is provided by American Trader Trustee Council, United States Geologic Survey, California Department of Fish and Game, Oil Spill Response, and in kind services are provided by the Channel Islands National Park.

Map 12: Brown Pelican and Cormorant Population Dynamics

Research Program: Breeding Colonies of Cassin's Auklets

Agency or Institution: United States Geological Survey, Western Ecological Research Center, San Francisco Bay Estuary Field Station

Contact: Josh Adams

Email: josh_adams@usgs.gov

Address: Moss Landing Marine Laboratories, 8272 Moss Landing Rd., Moss Landing, CA 95039-9647

Phone: 831-771-4422

Fax: 831-632-4403

Objectives: To determine at-sea distribution of radio-marked Cassin's Auklets around Prince Island and Scorpion Rock during 1999-2001.

Questions:

- What are the individual Cassin's Auklet and colony foraging ranges?
- Which prey species are delivered to auklet nestlings?
- What is the relationship of auklet locations to abiotic habitat features?

Data Collected: March 1999 – June 2001

Frequency of Data Collection: Seasonally (March-June). Tracking surveys every 2-8 days throughout the breeding season.

Data Type:

- Locations of radio-marked individuals (latitude and longitude)
- Diet collections (consist of euphausiids and larval fish)
- Remotely sensed data, including sea surface temperature (SST) and chlorophyll a concentrations

Availability of Data:

What format is used to store the data?

Excel spreadsheets, spatial data in ArcView

Are the data available to the public?

The data are not yet available to the public. The release of the data is pending completion of data analyses.

Research Program: Breeding Colonies of Cassin's Auklets

Techniques:

Standard aerial telemetry techniques focusing on the Santa Barbara Channel

Number of Species Studied: 1

Species List: Cassin's Auklet (*Ptychoramphus aleuticus*)

Number of Sites: From two breeding colonies

Location of Sites: Scorpion Rock and Prince Island

Staff Available for Monitoring: None currently available.

Resources Available for Monitoring: None currently available.

Annual Funding Level and Source: Cost of program is approximately \$175,000 per year, including rental boats and planes for transportation.

Map 13: Breeding Colonies of Cassin's Auklets

Research Program: Monitoring of Ashy Storm-Petrel Breeding Colonies

Agency or Institution: Fish and Wildlife Service; United States Geologic Survey, Biological Resources Division; Humboldt State University Foundation.

Contact: Bill McIver

Email: wrm805@aol.com

Address: Ventura, California

Phone: 805-643-6091

Objectives: To monitor reproductive success and timing of breeding of Ashy Storm-petrels at Santa Cruz Island.

Questions:

- Does timing and success of Ashy Storm-petrel breeding differ between year and/or locations?

Data Collected Since: May through November in each year from 1995-1998. Additional surveys were conducted in July from 1999-2002.

Frequency of Data Collection: Approximately every 3-5 weeks.

Data Type: Numbers of nesting birds. Nesting activities (i.e., adult on egg, chick present, egg present, empty) of each nest are observed during each trip.

Availability of Data: Data are stored in FoxPro databases and are not currently available to public.

Techniques: Sites were visited with aid of inflatable boats. Nests were investigated with the aid of headlamps and small flashlights.

Number of Species Studied: 1

Species List: Ashy Storm-petrel

Number of Sites: Five

Research Program: Monitoring of Ashy Storm-Petrel Breeding Colonies

Location of Sites: Santa Cruz Island (Bat Cave, Cave of Bird's Eggs, Cavern Point Cove Caves, Dry Sandy Beach Cave, and Orizaba Rock)

Staff Available for Monitoring:

Generally, 3 days are required to conduct research with 4-6 personnel each time.

Resources Available for Monitoring:

Boats for transportation provided by Channel Islands National Marine Sanctuary, Island Packers, private individuals, and California Department of Fish and Game.

Annual Funding Level and Source: not available

Map 14: Monitoring of Ashy Storm-petrel Breeding Colonies

Research Program: Seabird Population Dynamics

Agency or Institution: Channel Islands National Park

Contact: Paige Martin, Seabird Biologist

Email: Paige_Martin@nps.gov

Address: 1901 Spinnaker Dr, Ventura, CA 93001

Phone: 805-658-5764

Fax: 805-658-5798

Objectives: To monitor trends in seabird population dynamics

Questions:

- What is the abundance of seabirds at breeding colonies on the Channel Islands?
- What is the reproductive effort and success of seabirds at breeding colonies on the Channel Islands?
- What is the population age structure of seabirds at the Channel Islands?

Data Collected Since: 1985

Frequency of Data Collection: Data are collected over numerous visits to colonies between March and September (approximately). Information is presented as one number for each parameter annually (e.g., productivity for 2002, hatching success 2002, etc.) for each target species on each island monitored.

Data Type:

- Abundance of breeding birds
- Reproductive success and reproductive effort
- Phenology
- Population age structure

Availability of Data:

Data are stored in Microsoft Access database

Data are available for the public in reports, which can be delivered in hardcopy and viewed on the www.nps.gov/chis.

Research Program: Seabird Population Dynamics

Techniques:

Number of Species Studied: 9

Species List and Site Locations: Species monitored as noted below

	Monitored by CINP on these islands	Monitored by others in these areas	Number of sites grids or plots	Timing of breeding (monitoring period)
California Brown Pelican	Santa Barbara	W Anacapa	Island-wide	Jan-Sep
Double-crested Cormorant	Santa Barbara	Anacapa S Cal. Bight	Island-wide	Apr-Aug
Brandt's Cormorant	Santa Barbara	Anacapa S Cal. Bight	Island-wide	Mar-Jul
Pelagic Cormorant	Santa Barbara	Anacapa	Island-wide	Mar – Jul
Snowy Plover	Santa Rosa San Miguel	Santa Cruz San Nicolas	Island-wide	May, additional surveys in fall and winter
Western Gull	Santa Barbara Anacapa		3 2	Apr - Aug
Xantus's Murrelet	Santa Barbara	Anacapa	5	Mar – Jun/Jul
Cassin' Auklet	San Miguel Santa Cruz		2 1	Mar – Jul
Pigeon Guillemot	Santa Barbara		2	Mar - Jul

Staff Available for Monitoring:

One person is responsible for monitoring full-time. Monitoring conducted approximately 7-8 months each year. Assistance from other agencies is variable.

Resources Available for Monitoring:

National Park Service boat for transportation, Park Service housing on island

Annual Funding Level and Source:

Channel Islands National Park Service base funding

Populations: Marine Mammals

Research Program: Pinniped Population Studies

Agency or Institution: National Marine Mammal Laboratory, Alaska Fisheries Science Center, National Marine Fisheries Service

Contact: Dr. Robert Delong

Email: robert.delong@noaa.gov or sharon.melin@noaa.gov

Address: Building 4, 7600 Sand Point Way, N.E., Seattle, WA 98115

Phone: 206-526-4038

Fax: 206-526-6615

Objectives: To describe pinniped population biology

Questions:

- What is the status of pinnipeds on San Miguel Island?
- What do pinnipeds eat?
- Are diseases present in populations of pinnipeds on San Miguel Island?
- What are the birth and death rates for pinniped populations on San Miguel Island?
- What is the impact of environmental pollutants on pinniped health?

Data Collected Since: Since 1968

Frequency of Data Collection: Annually

Data Type:

Pinniped Population Assessment

Foraging ecology

Disease assessment

Vital rate assessments

Impact of environmental pollutants on pinniped health

Availability of Data:

Data are stored in Access and are not available to the public.

Techniques: San Miguel Island monthly surveys

Research Program: Pinniped Population Studies

Number of Species Studied: 5

Species List:

Mirounga angustirostris

Phoca vitulina

Callorhinus ursinus

Zalophus californianus

Arctocephalus townsendi

Number of Sites: 1

Location of Sites: San Miguel Island

Staff Available for Monitoring:

4 people; about 400 person days per year

Resources Available for Monitoring:

Boots, binoculars, and spotting scopes available

Annual Funding Level and Source:

About \$100,000-150,000 annually

Map 15: Pinniped Population Studies

Research Program: Aerial Monitoring of Pinnipeds

Agency or Institution: National Marine Fisheries Service, Southwest Fisheries Science Center (SWFSC)

Contact: Mark Lowry

Email: mark.lowry@noaa.gov

Address: 8604 La Jolla Shores Drive, La Jolla, CA 92037

Phone: 858-546-7174

Fax: 858-546-7003

Objectives: To monitor pinniped populations at the Channel Islands, California statewide, and in western United States.

Questions:

- Are pinniped populations decreasing, stable, or expanding?

Data Collected Since:

Aerial photographic surveys began in 1987. However, data was collected by biologists on land at various colonies since 1981.

Frequency of Data Collection:

Northern elephant seals are surveyed in mid-February; harbor seals are surveyed in May-July, and California sea lions and Steller sea lions (and northern fur seals) are surveyed in July.

Data Type:

Pinniped species are counted from 126-mm format aerial color photographs. Counts of the target species are kept in databases or spreadsheets. No n-target species that are in the photographs are not counted, but can be counted if funds and personnel are provided, although coverage of these species may be incomplete. In some cases there is GPS information accompanying the photographs. Counts are made of various age and sex class categories for northern elephant seals, California sea lions, Steller sea lions, and northern fur seals. Counts of harbor seal are not differentiated into age and sex class categories.

Research Program: Aerial Monitoring of Pinnipeds

Availability of Data:

Data is stored in either a Dbase file or spreadsheet file (Excel or Quatro Pro). Some data is available to the public in reports. Some data is not available to the public, but eventually will be available after publication. Photographs are available upon request.

Techniques:

Aerial color-transparency photographs are taken with a 126-mm format aerial reconnaissance camera with image motion compensation. The aircraft is flown at 700 feet altitude when surveying for California sea lions, Steller sea lions, northern fur seals, and harbor seals; and at 800 feet when surveying for northern elephant seals. Depending on the species being surveyed, entire coastlines, or portions of the coastline, have been photographed. At some locations (e.g., central and northern California, and some of the Channel Islands) only haulout sites with animals are photographed. In some cases multiple photographic passes are made, but single passes are made in most areas.

Surveys for northern elephant seals have only been made in the Channel Islands. Surveys for harbor seals are made for the entire state of California. Surveys for California sea lions are made at four colonies in the Channel Islands (San Clemente, Santa Barbara, San Miguel, and San Nicolas Islands) and in central and northern California. Northern fur seals and Steller sea lions are surveyed when California sea lions are surveyed.

Counts are conducted at Southwest Fisheries Science Center. The photographs are illuminated using a light table and counts are made directly from the photographs as a biologist examines the photograph through a zoom microscope.

Number of Species: 5

Studied Species List:

California sea lion (*Zalophus californianus*)
Steller sea lion (*Eumetipias jubata*)
Northern fur seal (*Callorhinus ursinus*)
Harbor seal (*Phoca vitulina*)
Northern elephant seal (*Mirounga angustirostris*)

Number of Sites: Many

Location of Sites: All of California and islands in Baja California, Mexico

Research Program: Aerial Monitoring of Pinnipeds

Staff Available for Monitoring:

One research fishery biologist spends 70% of staff time on these projects (including surveys, animal counts, and reports). Two other biologists help conduct harbor seal surveys.

Resources Available for Monitoring:

The aircraft is chartered from a private company. SWFSC owns the camera equipment and light tables. A research ship carrying a helicopter occasionally is available for surveying California sea lion colonies in Baja California, Mexico.

Annual Funding Level and Source:

Funding varies from year to year. Salary is covered at base funding level; each survey will cost \$10,000 to \$40,000 (depending on what is being surveyed).

Research Program: California Sea Lion Diet Studies

Agency or Institution: National Marine Fisheries Service, Southwest Fisheries Science Center (SWFSC)

Contact: Mark Lowry

Email: mark.lowry@noaa.gov

Address: 8604 La Jolla Shores Drive, La Jolla, CA 92037

Phone: 858-546-7174

Fax: 858-546-7003

Objectives:

- To monitor the diet of California sea lions as an indicator of when the population reaches carrying capacity
- To examine seasonal, annual, and multi-year variability in the diet
- To identify competition with humans for the same resource
- To evaluate the sea lion diet data as a fishery-independent index of abundance of commercial species of fish and squid

Questions:

- What do California sea lions eat and does it change through time?
- How much does the population of California sea lions consume?
- Do California sea lions compete with humans for the same resources?
- Can sea lion diet studies be used as a fishery-independent index of abundance of commercial species of fish and squid?
- Will the diet of sea lions become more variable when the population reaches carrying capacity?

Data Collected Since: 1981

Frequency of Data Collection: Quarterly (January, April, July, and October)

Data Type: Scat and spewing samples are collected at rookeries. Fish otoliths and cephalopod beaks (stored at SWFSC) are used for identifying prey species. Bones and other material from scat samples are archived. Length and biomass of some prey species consumed is available for some species.

Research Program: California Sea Lion Diet Studies

Availability of Data:

Data from scat samples is kept in an Access database file. The database is not available to the public. Reports are written periodically which are made available to the public.

Techniques:

Scat and spewing samples are collected at colonies in the Channel Islands. Samples are rinsed through nested sieves. Fish otoliths and cephalopod beaks are used to identify, enumerate, and estimate length and weight of prey species. Fifty scat samples (and any spewing present at the time of the survey) are collected at each site.

Number of Species Studied: 1

Species List: California sea lion (*Zalophus californianus*)

Number of Sites: 3 and sometimes 4

Location of Sites: San Clemente and San Nicolas Islands

Staff Available for Monitoring:

One research fishery biologist spends 30% of staff time on this project. Other biologists help collect samples; some are hired periodically for processing samples.

Resources Available for Monitoring:

Laboratory space at Southwest Fisheries Science Center.

Annual Funding Level and Source:

Salary of principal investigator is covered at base funding level. Travel and supplies are about \$1,500 to \$2,000 per year. Biological Aide for sorting samples costs about \$10,000 to \$15,000 per year.

Research Program: Harbor Seal Annual Census

Agency or Institution: California Department of Fish and Game

Contact: Robert B. Read

Email: rread@dfg.ca.gov

Address: 4949 Viewridge Avenue, San Diego, CA 92123

Phone: 858-467-4213

Fax: 858-467-4299

Objectives:

To assess on annual basis the population trend of harbor seals in California.

Questions:

- What is population trend of harbor seal in California?

Data Collected Since: 1982

Frequency of Data Collection: One or two aerial surveys per year.

Data Type: Aerial photographs.

Availability of Data:

Data are stored in electronic spreadsheet format for all years.

Data are stored in GIS format from DFG – ITB in Sacramento.

Techniques:

- Aerial photographs of harbor seal haul out sites
- Numbers of animals enumerated from film and recorded by date, location, and substrate

Number of Species Studied: One

Species List: *Phoca vitulina*

Research Program: Harbor Seal Annual Census

Number of Sites:

Approximately 500 statewide

Location of Sites:

Coastal beaches, offshore rocks, bays, estuaries and river mouths.

Staff Available for Monitoring:

Three staff briefly during May, June and July.

Resources Available for Monitoring:

Department of Fish and Game aircraft

Annual Funding Level and Source: California Department of Fish and Game and Pacific States Marine Fisheries Commission provides approximately \$10,000 to \$20,000 per year.

Research Program: Photo Identification of Humpback and Blue Whales

Agency or Institution: Cascadia Research

Contact: John Calambokidis

Email: calambokidis@cascadiaresearch.org

Address: 218½ W 4th Ave., Olympia, WA 98501

Phone: 360-943-7325

Fax: 360-943-7026

Objectives:

- To determine the abundance and trends in humpback and blue whales in the eastern North Pacific
- To describe the movement patterns and stock structure of humpback and blue whales
- To examine the underwater behavior of whales
- To examine aspects of human impacts on whales

Questions:

- What are population sizes and trends of humpback and blue whales in the eastern North Pacific Ocean?
- What are the movement patterns of humpback and blue whales?
- What is the underwater behavior of whales?
- What are the impacts of human activities on whales?

Data Collected Since: 1986

Frequency of Data Collection: Annually

Data Type:

Record sightings, movements, and abundance of a variety of marine mammals, with a focus on humpback and blue whales.

Availability of Data:

Data is available through annual reports, publications in scientific journals, and sharing with a number of larger databases

Research Program: Photo Identification of Humpback and Blue Whales

Techniques:

- Small boat surveys using rigid hull inflatable boats (RHIBs)
- Photographic identification of individual humpback and blue whales
- Mark-recapture to calculate abundance
- Application of suction-cup attached tags to monitor underwater behavior
- Collection of skin samples for genetics with biopsy darts

Number of Species Studied:

All marine mammals with a focus on humpback and blue whales

Species List:

All marine mammals

Location and Number of Sites:

Research conducted all along the coast of California, Oregon, and Washington. In the Channel Islands region, most of the field work is done in the southern portion of the Santa Barbara Channel and other areas generally outside Sanctuary waters.

Staff Available for Monitoring:

Most research conducted by two staff working part-time

Resources Available for Monitoring:

Most research conducted from 2 RHIBs and occasionally based from larger platforms including NOAA and SIO ships.

Annual Funding Level and Source:

Funding for assessment and tagging work generally about \$100,000 per year with principal funding from Southwest Fisheries Science Center (NOAA) and ONR (Navy) with some occasional support from National Marine Sanctuaries.

Category 2: Communities (Multi-species complexes)

Research Program: Sand Beach and Coastal Lagoon Monitoring

Agency or Institution: Channel Islands National Park

Contact: Dan Richards

Email: dan_richards@nps.gov

Address: 1901 Spinnaker Drive, Ventura, CA

Phone: 805-658-5760

Fax: 805-658-5798

Objectives:

- To monitor trends in population dynamics of selected indicator organisms
- To determine normal limits of variation of selected indicator organisms
- To discover abnormal conditions (such as alien species or changes due to oil spills, climate change, harvest, etc.)
- To identify and communicate issues to park management and collaborators
- To measure effectiveness of management actions

Data Collected Since: Research on the program design began in 1988; monitoring began in 1994.

Frequency of Data Collection: Annually

Data Type:

Species densities, percent cover of beach wrack, size distribution and reproductive status of sand crabs.

Availability of Data:

What format is used to store the data? Access Database

Are the data available to the public? Data are available in reports available online or in print at www.nature.nps.gov/im/units/chis/HTMLpages/MarineReports2.htm

Raw data are available by written request.

Research Program: Sand Beach and Coastal Lagoon Monitoring

Techniques:

- Five upper beach core transects
- Five wash-zone core transects
- Three point contact transects
- Three to five visual transects
- Mark/recapture and size distribution
- Beach seines

Number of Species Studied: the number varies by site

Primary Species List:

Tivela stultorum
Excirolana chiltoni
Emerita analoga
Blepharipoda occidentalis
Melalorchestia spp.
Euzonus mucronata
Staphylinidae
Olivella biplicata

Number of Sites: 12

Location of Sites: Santa Rosa Island (Abalone Rocks, Becher's Pier, Bee Rock, China Camp, Ford Point, Oat Point, Old Ranch, Old Ranch House, Southeast Anchorage, Sandy Point, Soledad West, and Water Canyon)

Staff Available for Monitoring: No staff is dedicated to this project

Resources Available for Monitoring: Transportation to islands as needed

Annual Funding Level and Source:

There is no funding currently dedicated to this program.

Map 16: Sand Beach and Coastal Lagoon Monitoring

Research Program: Rocky Intertidal Monitoring Program

Agency or Institution: Channel Islands National Park

Contact: Dan Richards

Email: dan_richards@nps.gov

Address: 1901 Spinnaker Drive, Ventura, CA

Phone: 805-658-5760

Fax: 805-658-5798

Objectives:

- To monitor trends in population dynamics of selected indicator organisms
- To determine normal limits of variation of selected indicator organisms
- To discover abnormal conditions (such as alien species or changes due to oil spills, climate change, harvest, etc.)
- To identify and communicate issues to park management and collaborators
- To measure effectiveness of management actions

Questions:

- What is the status of black abalone populations?
- What is the status of giant owl limpet populations?
- What effects do visitors have on intertidal zone benthic organisms (specifically effects from trampling)?

Data Collected Since: Anacapa Island sites were established in 1982 and have been monitored biannually since. Sites on Santa Barbara and San Miguel Islands were established in 1985, Santa Rosa Island, 1985-1988, and Santa Cruz Island, 1994.

Frequency of Data Collection: Biannually

Data Type:

- Percent cover (point contact photoplots) of benthic invertebrates and algae in fixed plots
- Size and density of black abalone and giant owl limpets in fixed plots
- Relative abundance and sizes of seastars
- Percent cover (point contact fixed transects) of surfgrass

Research Program: Rocky Intertidal Monitoring Program

Availability of Data:

What format is used to store the data? Access Database

Are the data available to the public? Data are available in reports available online or in print at www.nature.nps.gov/im/units/chis/HTMLpages/MarineReports2.htm

Raw data are available by written request.

Techniques:

- Twenty-two sites around five islands utilize fixed photoplots (Five 50x75 cm plots per zone in 3-7 zones depending on assemblages present)
- Five fixed irregular abalone plots
- Five fixed 1m-radius owl limpet plots
- Three 10 m surfgrass transects
- Recently we have begun developing methods for quantifying small mobile invertebrates e.g., snails, chitons, and crabs.

Number of Species Studied: the number varies by site

Primary Species List:

Haliotis cracherodii

Lottia gigantea

Hesperophycus californicus

Silvetia compressa

Endocladia muricata

Phyllospadix scouleri/torreyi

Anthopleura elegantissima/solis

Mytilus californianus

Chthamalus spp/Balanus glandula

Tetraclita rubescens

Pollicipes polymerus

Pisaster ochraceus

Research Program: Rocky Intertidal Monitoring Program

Number of Sites: 22

Location of Sites: Anacapa Island (Cat Rock, Harbor Seal Arch, Middle-East, Middle-West, S. Frenchy's Cove); Santa Barbara Island (Landing Cove, Sea Lion Rookery); Santa Cruz Island (Fraser Cove, Orizaba Cove, Prisoner's Harbor, Scorpion Rock, Trailer, Willows Anchorage); San Miguel Island (Cuyler Harbor, Crook Point, Harris Point, Otter Harbor), Santa Rosa Island (East Point, Ford Point, Fossil Reef, Johnson's Lee, NW Talcott).

Staff Available for Monitoring:

Two staff position each approximately half time

Resources Available for Monitoring:

Camera, electronic strobes, and transportation to islands as needed

Annual Funding Level and Source: National Park Service provides base funding at a level of approximately \$60,000 per year.

Map 17: Rocky Intertidal Monitoring Program

Research Program: Kelp Forest Monitoring Program

Agency or Institution: Channel Islands National Park

Contact: David Kushner

Email: David_kushner@nps.gov

Address: 1901 Spinnaker Dr.

Phone: 805-658-5773

Fax: 805-658-5798

Objectives: To collect a long-term baseline for 66 species or groups of taxa that will help describe the population dynamics of the kelp forest ecosystems around the five Park Islands.

Questions: The project was not designed to answer specific questions.

Data Collected Since: 1982

Frequency of Data Collection: Annually

Data Type: We have fishery-independent data on 68 species or groups of taxa. This data includes density data, percent cover, size frequency, recruitment, and temperature.

Availability of Data: A Microsoft Access database is used to store data. Summary data is available to the public on the park web site. Raw data is available to the public upon written request.

Techniques:

16 fixed 100 meter transects on the five park islands. Techniques include, Quadrats, 5-meter quadrats, band transects, random point contacts, fish transects, video transects, roving diver fish count, species list surveys, artificial recruitment modules, size frequency measurements, and remote temperature loggers. For complete protocol descriptions please refer to:
www.nature.nps.gov/im/units/chis/HTMLpages/KFM-HandbookVol1.pdf

Number of Species Studied:

68 species (algae, invertebrates and vertebrates) or groups of taxa

Research Program: Kelp Forest Monitoring Program

Species List: Regularly monitored species by taxonomic grouping, common name, scientific name and associated monitoring technique.

TAXA/COMMON NAME	SCIENTIFIC NAME	TECHNIQUE
ALGAE		
Miscellaneous green algae		R
Miscellaneous red algae		R
Articulated coralline algae		R
Encrusting coralline algae		R
Agar weed	<i>Gelidium spp.</i>	R
Sea tongue	<i>Gigartina spp.</i>	R
Miscellaneous brown algae		R
Acid weed	<i>Desmarestia spp.</i>	R
Oar weed	<i>Laminaria farlowii</i>	R,Q
Bladder chain kelp	<i>Cystoseira spp.</i>	R
Giant kelp	<i>Macrocystis pyrifera</i>	R,Q,M
California sea palm	<i>Pterygophora californica</i>	R,Q
Southern sea palm	<i>Eisenia arborea</i>	R,Q
INVERTEBRATES		
Miscellaneous sponges		R
Orange puffball sponge	<i>Tethya aurantia</i>	B,S
Southern staghorn bryozoan	<i>Diaperoecia californica</i>	R
Miscellaneous bryozoans		R
California hydrocoral	<i>Stylaster californica</i>	B,S
White-spotted rose anemone	<i>Tealia lofotensis</i>	B
Red gorgonian	<i>Lophogorgia chilensis</i>	B,S
Brown gorgonian	<i>Muricea fruticosa</i>	B,S
Californian golden gorgonian	<i>Muricea californica</i>	B,S
Strawberry anemone	<i>Corynactis californica</i>	R
Orange cup coral	<i>Balanophyllia elegans</i>	R
Cup coral	<i>Astrangia lajollaensis</i>	R
Ornate tube worm	<i>Diopatra ornata</i>	R
Colonial sand-tube worm	<i>Phragmatopoma californica</i>	R
Scaled-tube snail	<i>Serpulorbis squamigerus</i>	R
Chestnut cowrie	<i>Cypraea spadicea</i>	Q
Wavy turban snail	<i>Lithopoma undosum</i>	Q,S
Red turban snail	<i>Lithopoma undosum</i>	Q,S
Bat star	<i>Asterina miniata</i>	Q,S
Giant-spined sea star	<i>Pisaster giganteus</i>	Q,S,M
Sunflower star	<i>Pycnopodia helianthoides</i>	B,S
White sea urchin	<i>Lytechinus anamesus</i>	B,S
Red sea urchin	<i>Strongylocentrotus franciscanus</i>	Q,S

Research Program: Kelp Forest Monitoring Program

Species List: Regularly monitored species by taxonomic grouping, common name, scientific name and associated monitoring technique.

TAXA/COMMON NAME	SCIENTIFIC NAME	TECHNIQUE
INVERTEBRATES cont.		
Purple sea urchin	<i>Strongylocentrotus purpuratus</i>	Q,S
Warty sea cucumber	<i>Parastichopus parvimensis</i>	Q
Aggregated red sea cucumber	<i>Pachythyone rubra</i>	R
Red abalone	<i>Haliotis rufescens</i>	B,S
Pink abalone	<i>Haliotis corrugata</i>	B,S
Green abalone	<i>Haliotis fulgens</i>	B,S
Kellett's whelk	<i>Kelletia kelletii</i>	B,S
Giant keyhole limpet	<i>Megathura crenulata</i>	B,S
California brown sea hare	<i>Aplysia californica</i>	B
Rock scallop	<i>Crassidoma giganteum</i>	B,S
California spiny lobster	<i>Panulirus interruptus</i>	B
Tunicates		R
Stalked tunicate	<i>Styela montereyensis</i>	Q
Miscellaneous invertebrates		R
FISH		
Bluebanded goby	<i>Lythrypnus dalli</i>	Q
Blackeye goby	<i>Coryphopterus nicholsii</i>	Q
Island kelpfish	<i>Alloclinus holderi</i>	Q
Blacksmith	<i>Chromis punctipinnis</i>	V
Señorita	<i>Oxyjulis californica</i>	V
Blue rockfish	<i>Sebastes mystinus</i>	V
Olive rockfish	<i>Sebastes serranoides</i>	V
Kelp rockfish	<i>Sebastes atrovirens</i>	V
Kelp bass	<i>Paralabrax clathratus</i>	V
California sheephead	<i>Semicossyphus pulcher</i>	V
Black surfperch	<i>Embiotoca jacksoni</i>	V
Striped surfperch	<i>Embiotoca lateralis</i>	V
Pile perch	<i>Damalichthys vacca</i>	V
Garibaldi	<i>Hypsypops rubicundus</i>	V
Opaleye	<i>Girella nigricans</i>	V
Rock wrasse	<i>Halichoeres semicinctus</i>	V
SUBSTRATE:		
Bare substrate		R
Substrate types: Rock		R
Cobble		R
Sand		R

Research Program: Kelp Forest Monitoring Program

Number of Sites: 16

Location of Sites: Anacapa Island (Admiral's Reef, Cathedral Cove, Landing Cove); Santa Barbara Island (Arch Point, Cat Canyon, SE Sea Lion Rookery); Santa Cruz Island (Fry's Harbor, Gull Island South, Pelican Bay, Scorpion Anchorage, Yellowbanks); San Miguel Island (Hare Rock, Wykoff Ledge), Santa Rosa Island (Johnson's Lee North, Johnson's Lee South, Rodes Reef).

Staff Available for Monitoring:

Current level: One full time position and one half time (six months) position. If project is fully funded, then staff available for monitoring includes one full time and three half time (six months) staff.

Resources Available for Monitoring:

National Park Service boat *Pacific Ranger* approximately 35 days per year

Annual Funding Level and Source:

The current level of funding from the National Park Service is approximately \$113,000 per year. This does not include the cost of the boat and personnel to operate the boat, which is approximately \$70,000 per year.

Map 18: Kelp Forest Monitoring Program

Research Program: Subtidal Monitoring at San Miguel Island

Agency or Institution: California Abalone Association

Contact: Jim Marshall

Address: c/o Channel Islands National Marine Sanctuary, 113 Harbor Way,
Suite 150, Santa Barbara, CA 93109

Phone: 805-966-7107

Objectives:

- To establish a monitoring transect site for red abalone and to install artificial recruitment modules (ARMs) within an area that supports abundant abalone.
- To monitor and report findings on abalone size, density, and populations levels at the site.
- To provide a video of data collection activities and conditions at the site.
- To provide data to California Department of Fish and Game, Channel Islands National Park, and the Channel Islands National Marine Sanctuary.
- To demonstrate that commercial fishermen and divers can provide academia and regulatory agencies low-cost and efficient site installation, monitoring and data collection.

Questions:

- What is the density and population age structure of subtidal organisms?
- What is the abundance and distribution of rare and clumped species?
- Are band transects and video-taped transects more effective for surveying rare and clumped organisms than quadrats?

Data Collected Since: 2001-2002

Frequency of Data Collection: 5 trips between August 2001 and February 2002.

Data Type:

Number of individuals per unit area
Video transect

Availability of Data:

Data are available upon request. Report available on red abalone.

Research Program: Subtidal Monitoring at San Miguel Island

Techniques:

Survey Method	Description
Band transects	To determine the abundance and distribution of rare and clumped organisms not adequately sampled by quadrats.
Video-taped transects	To record the general appearance of each site along a fixed lead line transect following similar procedures employed for the visual fish transects.
Size Frequency Surveys	To estimate population age structure and to identify and monitor recruitment cohorts.
Artificial Recruitment Modules	To conduct standardized invasive size frequency sampling for selected indicator species. The size frequency distributions are used to identify and monitor recruitment cohorts.

Number of Sites:

24 discrete 30-m² band transects

2 video transects along the main transect

1 size frequency transect within 1.5 m of the main transect

8 Artificial Recruitment Modules

Number of Species Studied: 25

Species List: Band Transects

Orange Puffball Sponge (*Tethya aurantia*)

California Hydrocoral (*Stylaster [Allopora] californicus*)

White-spotted Rose Anemone (*Urticina [Telia] lofotensis*)

Red Gorgonian (*Lophogorgia chilensis*)

Brown Gorgonia (*Muricea fruticosa*)

California Golden Gorgonian (*Muricea californica*)

Giant Keyhole Limpet (*Megathura crenulata*)

Red Abalone (*Haliotis rufescens*)

Pink Abalone (*Haliotis corrugata*)

Green Abalone (*Haliotis fulgens*)

Kellett's Whelk (*Kelletia kelletii*)

Rock Scallop (*Crassidoma [Hinnites] giganteum*)

White Sea Urchin (*Lytechinus anamesus*)

Sunflower Sea Star (*Pycnopodia helianthoides*)

California Brown Sea Hare (*Aplysia californica*)

California Spiny Lobster (*Panulirus interruptus*)

Research Program: Subtidal Monitoring at San Miguel Island

Species List: Size Frequency Surveys

Giant Kelp (*Macrocystis pyrifera*)
Orange Puffball Sponge (*Tethya aurantia*)
California Hydrocoral (*Stylaster [Allopora] californicus*)
Red Gorgonian (*Lophogorgia chilensis*)
Brown Gorgonia (*Muricea fruticosa*)
California Golden Gorgonian (*Muricea californica*)
Giant Keyhole Limpet (*Megathura crenulata*)
Red Abalone (*Haliotis rufescens*)
Pink Abalone (*Haliotis corrugata*)
Green Abalone (*Haliotis fulgens*)
Lithopoma [Astraea] giganteus
Lithopoma [Astraea] gibberosum
Kellet's Whelk (*Kelletia kelletii*)
Rock Scallop (*Crassidoma [Hinnites] giganteum*)
Purple Sea Urchin (*Strongylocentrotus purpuratus*)
Red Sea Urchin (*Strongylocentrotus franciscanus*)
White Sea Urchin (*Lytechinus anamesus*)
Sunflower Sea Star (*Pycnopodia helianthoides*)
Astrina [Patiria] miniata
Pisaster giganteus

Species List: Artificial Recruitment Modules

Orange Puffball Sponge (*Tethya aurantia*)
Red Abalone (*Haliotis rufescens*)
Pink Abalone (*Haliotis corrugata*)
Green Abalone (*Haliotis fulgens*)
Cypraea spadicea
Lithopoma [Astraea] giganteus
Lithopoma [Astraea] gibberosum
Kellet's Whelk (*Kelletia kelletii*)
Giant Keyhole Limpet (*Megathura crenulata*)
Rock Scallop (*Crassidoma [Hinnites] giganteum*)
Astrina [Patiria] miniata
Pisaster giganteus
Sunflower Sea Star (*Pycnopodia helianthoides*)
White Sea Urchin (*Lytechinus anamesus*)
Purple Sea Urchin (*Strongylocentrotus purpuratus*)
Red Sea Urchin (*Strongylocentrotus franciscanus*)
Sea Cucumber (*Parastichopus parvimensis*)
Centrostephanus cornoatus

Research Program: Subtidal Monitoring at San Miguel Island

Staff Available for Monitoring:

Band transects and video-taped transects require 2 SCUBA divers.

Size frequency surveys and artificial recruitment modules require 6 SCUBA divers.

Resources Available for Monitoring:

Annual Funding Level and Source:

\$7,500 provided by the Collaborative Marine Research Program at the Channel Islands National Marine Sanctuary

Map 19: Subtidal Monitoring at San Miguel Island

Research Program: Reef Environmental Education Foundation (REEF) Monitoring

Agency or Institution: Reef Environmental Education Foundation (REEF), a 501(c)(3) organization

Contact: Dr. Christy Pattengill-Semmens, Scientific Coordinator (located at REEF Pacific Office)

Email: christy@reef.org

Address: PO Box 246, Key Largo, FL 330307 (HQ), 4726 38th Ave NE, Seattle, WA 98105 (Pacific Office)

Phone: 305-852-0030 (HQ), 206-529-1240 (Pacific Office)

Fax: 305-852-0301 (HQ)

Objectives:

- To collect information on the distribution and abundance of marine fishes
- To monitor changes over time in marine fish populations
- To enable volunteers to collect meaningful information
- To provide scuba divers a non-extractive activity

Questions:

Because REEF's Fish Survey Project is a monitoring program, it is not question driven. REEF data have been used to address a variety of questions, including –

- Where are high diversity areas?
- Are harvest restrictions effective?
- What is the status of a particular stock?

Data Collected Since: June 28, 1997

Frequency of Data Collection: ongoing, volunteers can conduct surveys anytime. There are currently 774 surveys in the database from the Channel Islands National Marine Sanctuary and over 50,000 surveys program-wide.

Research Program: Reef Environmental Education Foundation (REEF) Monitoring

Data Type:

- Fish presence and abundance estimate
- Surface temperature in °C
- Bottom temperature in °C
- Survey time in minutes
- Dive start time
- Horizontal visibility estimate
- Average depth of survey
- Current (strong, weak, none)
- Habitat type over which the majority of the survey took place (there are 11 types)

Availability of Data:

The data are organized in a SQL database. Data are available to the general public in summary format (species lists, sighting frequency, density score) via the REEF Website (www.reef.org). Raw datafiles in text file format are available on request.

Techniques:

The Roving Diver Technique (RDT; Schmitt and Sullivan 1996) is a non-point visual survey method specifically designed to generate a comprehensive fish species list along with frequency and abundance estimates. During RDT surveys, divers swim freely throughout a dive site and record every observed fish species. The survey is generally restricted to within a 100-m radius of the starting point. At the conclusion of each survey, divers assign each recorded species one of four log₁₀ abundance categories [single (1); few (2-10), many (11-100), and abundant (>100)]. Following the dive, each surveyor records the species data along with survey time, depth, temperature, and other environmental information on a REEF scansheet. The scansheets are returned to REEF, and the data are loaded into the REEF database that is accessible to the public on the Internet at www.reef.org. Each dive is one survey. The survey program is ongoing and the number of surveys conducted per site varies.

Number of Species Studied: The REEF database currently contains sighting information on 111 marine fish species from the CINMS.

Species List: See summary report at www.reef.org/cgi-bin/georep.pl?region=PAC&geogr=4202&geogr=420301

Number of Sites: The REEF database currently contains surveys from 77 sites from all five Channel Islands.

Research Program: Reef Environmental Education Foundation (REEF) Monitoring

Location of Sites:

Map 20 includes 72 of 77 sites in the Channel Islands National Marine Sanctuary. Latitude and longitude points are not available for 5 surveys. Some of the location points may be off slightly.

Staff Available for Monitoring:

There are 4 full-time REEF staff members and all participate in survey projects. However, volunteers conduct the majority of the surveys. A highly experienced sub-set of the volunteers, the Advanced Assessment Team, is made up of REEF Experts and is used to help fulfill monitoring and research contracts that REEF is awarded.

Resources Available for Monitoring:

There are no REEF resources available for monitoring.

Annual Funding Level and Source:

The entire budget of REEF in 2002 was approximately \$550,000, and funding sources include membership contributions, foundations, and contracts from federal and state agencies. A portion of the budget is directed toward specific data collection efforts throughout REEF's project region. Volunteers collected the majority of data in the Channel Islands National Marine Sanctuary and elsewhere. REEF receives several monitoring contracts each year that enable targeted data collection in specific areas.

Map 20: Reef Environmental Education Foundation (REEF) Monitoring

Research Program: Biogeography of Nearshore Fishes

Agency or Institution: Vantuna Research Group, Occidental College

Contact: Dr. Dan Pondella

Email: Pondella@oxy.edu

Address: Moore Laboratory of Zoology, Occidental College, 1600 Campus Rd.
Los Angeles, CA 90041

Phone: 323-259-2955

Fax: 323-259-2887

Objectives: To understand the distribution, abundance and biogeography of nearshore fishes in the Southern California Bight

Questions:

- What are the composition and abundance of fish species in the Southern California Bight?

Data Collected Since: 2000 at Channel Islands

Frequency of Data Collection: varies by site, finest scale is monthly.

Data Type:

Fish density and water quality parameters

Availability of Data:

Data is stored in Paradox and Microsoft Excel

Data is not available to the public.

Techniques:

50-meter band transects are used for sampling.

Usually at least 12 repetitions per site are conducted.

Number of Species Studied: All species

Research Program: Biogeography of Nearshore Fishes

Number of Sites: 8 in study region

Location of Sites: Ventura; Santa Barbara; Santa Barbara Island (Sutil Island, Boilers), and Santa Cruz Island (Cavern Point, Middle Arch).

Staff Available for Monitoring:
20 staff

Resources Available for Monitoring:
85' R/V *Vantuna* and various skiffs

Annual Funding Level and Source:
Internal funding only

Map 21: Biogeography of Nearshore Fishes

Research Program: Partnership for Interdisciplinary Studies of Coastal Oceans (PISCO)

Agency or Institution: University of California, Santa Barbara; University of California, Santa Cruz; Stanford University; Oregon State University, Corvallis

Contact: Dr. Jenn Caselle

Email: caselle@lifesci.ucsb.edu

Address: Ecology, Evolution and Marine Biology, University of California, Santa Barbara, CA 93106

Phone: 805-893-5144

Fax: 805-893-4724

For more information about PISCO see www.piscoweb.org

Objectives:

- To initiate a novel program in interdisciplinary training and research
- To determine the processes underlying the dynamics of the coastal ecosystems along the U.S. West Coast
- To establish the scientific basis for the effective design, monitoring and evaluation of marine reserves and other conservation measures
- To begin to integrate this knowledge into the public and policy arenas

Questions: Recruitment

- What are the rates of recruitment of marine organisms to rocky subtidal populations?
- What are the spatial and temporal patterns in recruitment rates? How are these patterns influenced by oceanographic processes? How do these patterns relate to habitat features?
- To what extent is community structure (or changes in community structure over time) determined by recruitment?
- What are the spatial and temporal scales of dispersal of marine larvae?
- Do recruitment rates differ inside and outside of marine reserves?

Questions: Community Structure

- What are the spatial patterns of rocky subtidal community structure?
- How do these spatial patterns relate to habitat features and coastal oceanographic conditions?
- How does the structure of these communities vary over time?
- How do these changes over time relate to temporal changes in coastal oceanographic conditions?

Research Program: PISCO

Questions: Community Structure

- What are the specific environmental and ecological processes responsible for the observed patterns of (and changes in) community structure?
- Do spatial and temporal patterns of community structure differ inside and outside of marine reserves and if so, how?

Availability of Data:

What format is used to store the data?

Currently data are stored on a private file server in text format.

Are the data available to the public?

Summaries of PISCO data can be made available to the public upon request. Eventually, the public will be able to access PISCO data through a web-based interface.

Location of Sites:

Santa Cruz Island (Scorpion, Pelican, Hazards, Trailer near Forney's, Willows, Valley, Smugglers, Yellowbanks, Forney's, Prisoners); Anacapa Island (Landing Cove, Winfield Scott)

Number of Sites:

Data Type	No. Sites	Location of Sites
Physical characterization Invert relative recruitment	9	Scorpion, Pelican, Hazards, Trailer, Willows, Valley, Smugglers, Landing Cove, Winfield Scott
Fish relative recruitment	7-9	Pelican, Hazards, Trailer, Willows, Yellowbanks, Landing Cove, Winfield
Mussel growth rates	8	Scorpion, Pelican, Hazards, Trailer, Willows, Valley, Smugglers, Landing Cove
Fish, invert, and algal recruit density Fish, invert, and algal density	6	Pelican, Hazards, Forney, Yellowbanks, Landing Cove, Winfield Scott
Water chemistry	varies 3-5	Varies, Santa Cruz Island
Current speed and direction	varies	Varies, Santa Cruz Island
Fish and invert relative recruitment	2	Valley, Prisoner's
Home range size Average movement Site fidelity	1	Anacapa Island

Research Program: PISCO

Data Type	Techniques	Frequency of Data Collection	Data Collected Since
Physical			
Temperature	Onset tidbits, at 14-m, 10-m, and 5-m depths	Continuous, 2 min intervals	Apr 2000-present
Salinity	CTD	Approx. monthly	Apr 2000-present
Chlorophyll a, b	Water sampling	Approx. monthly	Apr 2000-present
Nutrients	Water sampling	Approx. monthly	Apr 2000-present
Current speed and direction	ADCP and S-4 current meters	Continuous	Jul 2000-present
Community Surveys			
Fish Density	Visual Surveys (30mx2m swath, bottom, middle and canopy)	Annual (Fall)	1999 (Anacapa only), added Prisoners and Hazards in 2000, added Forney and Yellowbanks in 2001
Inverts/Macroalgae density, percent cover	Visual Surveys (30-m x 2-m, quadrats, Uniform point contact)	Annual (Late summer, Fall)	1999 (Anacapa only), added Prisoners and Hazards in 2000, added Forney and Yellowbanks in 2001
Fish Density	Visual Surveys (30-m x 2-m, bottom, middle and canopy)	Annual (Winter)	Jan 2001-Jan 2003
Movement Studies			
Home range size, average movement	External tagging, visual resighting, retrapping	Approx. monthly	Oct 2001
Site fidelity	Acoustic telemetry monitoring	Continuous	Jul 2002-present

Research Program: PISCO

Data Type	Techniques	Frequency of Data Collection	Data Collected Since
Recruitment			
Invertebrate relative recruitment	Tuffies, plates on moorings	Monthly (year around)	Apr 2000-Nov 2002
Fish relative recruitment	SMURFS on moorings	Biweekly (April-Nov)	Jul 2000-Oct 2002
Fish recruit density	Visual Surveys (30-m x 2-m swath, bottom, middle and canopy)	Annual (Fall)	1999 (Anacapa only), added Prisoners and Hazards in 2000, added Forney and Yellowbanks in 2001
Invertebrate recruit density	Visual Surveys (1-m ² quadrats)	Annual (Late summer, Fall)	1999 (Anacapa only), added Prisoners and Hazards in 2000, added Forney and Yellowbanks in 2001
Macroalgae recruit density	Visual Surveys (1-m ² quadrats)	Visual Surveys (1m ² quadrats)	1999 (Anacapa only), added Prisoners and Hazards in 2000, added Forney and Yellowbanks in 2001
Invertebrate relative recruitment	Tuffies, plates on moorings	Every 2 days	Jul 2002-Sep 2002
Fish relative recruitment	SMURFS on moorings	Every 2 days	Jul 2002-Sep 2002
Growth studies			
Mussel growth rates	Outplanting mussels on moorings		Summer and Fall 2000
Larval transport studies			
Water chemistry (trace elements)	DGT's (Diffusive gradient thin films)	Intermittent, summer and fall	Summer 2001-present

Research Program: PISCO

Project	Future Directions
Physical Data	Probably will continue data collection, but likely will reduce the number of moorings at Santa Cruz Island and add moorings at Santa Rosa and San Miguel Islands. May add additional ADCPs to measure current speed and direction.
Recruitment	
Invertebrate relative recruitment	Program ended Dec 2002
Fish relative recruitment	Probably will continue data collection, but likely will reduce the number of moorings at Santa Cruz Island and add moorings at Santa Rosa and San Miguel Islands.
Fish, invertebrate, macroalgae recruit density	To be continued
Invertebrate and fish relative recruitment	Short-term experiments
Community Surveys	
Fish, invertebrate, and macroalgae density	To be continued
Growth	
Mussel growth rates	Project will be terminated upon completion
Movement	
Home range size, average movement	Program ended Dec 2002
Site fidelity	Tags will persist until late 2003

Research Program: PISCO

Staff Available for Monitoring:

2 principal investigators, 2 science coordinators, 1 policy coordinator, 6 postdoctoral researchers, 3 information managers, 15 graduate students, 6 research technicians, and 2 research fellows.

Resources Available for Monitoring:

Annual Funding Level and Source:

>\$200,000 per year from the David and Lucille Packard Foundation

Number of Species Studied:

Invertebrate relative recruitment (~30 species)

Fish relative recruitment (~10 species)

Fish recruit density (all species)

Home range size, average movement (~12 species)

Site fidelity (2 species)

Species List: Tuffies

Alia sp.

Amphissa versicolor

Bivalvia

Bulla sp.

Caecum californicum

Cancer spp. (8)

Chitons

Clams

Crassodoma giganteus

Crepidula sp.

Epitonium sp.

Eulithidium sp.

Hemigrapsus spp. (4)

Hiatella arctica

Irus lamellifer

Lacuna sp.

Leptopecten latiatratus

Limaria hemphilli

Littorina sp.

Lophopanopeus sp.

Lytechinus anemexus

Mitrella sp.

Mytilus spp.

Ocenebra sp.

Ophiuroid species

Pachycheles sp.

Pachygrapsus spp. (2)

Petrolisthes spp. (2)

Pododesmus cepio

Prosobranch spp.

Pugettia spp. (5)

Pycnogonid sp.

Pyromaia spp. (2)

Septifer bifurcatus

Siliqua patula

Strongylocentrotus spp. (2)

Tegula sp.

Tricolia spp.

Species List: SMURFS

Coryphopterus nicholsii

Chromis punctipinnis

Clinidae, Cottidae

Gibbonsia spp. (3)

Gobiesocidae

Gymnothorax mordax

Heterostichus rostratus

Hypsoblennius spp. (2)

Liparidae

Nautichthys oculofasciatus

Paralabrax clathratus

Scorpaenichthys marmoratus

Sebastes spp. (7)

Research Program: PISCO

Species List:

Subtidal Community Survey

Alloclinus holderi
Amphistichus spp. (3)
Anarrhichthys ocellatus
Anisotremus davidsonii
Artedius spp.
Atherinops spp.
Atherinopsis californiensis
Aulorhynchus flavidus
Brachyistius frenatus
Caulolatilus princeps
Cephaloscyllium ventriosum
Chromis punctipinnis
Citharichthys sordidus
Coryphopterus nicholsii
Cymatogaster aggregata
Cynoscion nobilis
Damalichthys vacca
Embiotoca spp. (2)
Engraulis mordax
Genyomemus lineatus
Gibbonsia spp.
Girella nigricans
Halicoeres semicinctus
Hermasilla azurea
Heterodontus spp. (2)
Heterostichus rostratus
Hexagrammos spp. (2)
Hyperprosopon spp. (2)
Hypsutus caryi
Hypsypops rubicundus
Lethops connectens
Leuresthes tenuis
Lythrypnus spp. (2)
Medialuna californiensis
Menticirrhus undulatus
Micrometrus spp. (2)
Myliobatis californica
Neoclinus blanchardi
Ophiodon elongatus
Oxyjulis californica
Oxylebius pictus

Paralabrax spp. (3)
Paralichthys californicus
Phanerodon spp. (2)
Porichthys spp. (2)
Rhacochilus toxotes
Sardinops sagax
Scomber japonicus
Scorpaena guttata
Scorpaenichthys marmoratus
Sebastes spp. (35)
Semicossyphus pulcher
Seriola dorsalis
Sphyaena argentea
Squalus acanthias
Squatina californica
Stereolepis gigas
Syngnathus spp.
Trachurus symmetricus
Triakis semifasciata
Ulvicola sanctaerosae
Xenistius californiensis
Zalembeius rosaceus

Map 22: Partnership for Interdisciplinary Studies of Coastal Oceans (PISCO)

Research Program: Wind to Whales

Agency or Institution: University of California, Santa Cruz

Contact: Dr. Donald Croll

Email: dcroll@cats.ucsc.edu

Address: Island Conservation and Ecology Group, Institute of Marine Sciences, University of California, Santa Cruz, CA 95064

Phone: 831-459-3610

Fax: 831-459-3383

Objectives: See proposal

Questions: See proposal

Data Collected: July 1995, May-September 1997; August-October 2000

Frequency of Data Collection:

Data Type: See proposal

Availability of Data:

What format is used to store the data? Flat ASCII

Are the data available to the public? No

Techniques: Ship-based surveys (see proposal)

Number of Species Studied: All birds, mammals and krill

Species List: N/A

Number of Sites: N/A

Location of Sites: See proposal

Staff Available for Monitoring: None currently

Resources Available for Monitoring: None currently

Annual Funding Level and Source: None currently

Research Program: Sanctuary Naturalist Corps

Agency or Institution: Channel Islands National Marine Sanctuary (CINMS)

Contact: Shauna Bingham

Email: Shauna.Bingham@noaa.gov

Address: Channel Islands Harbor, 3600 South Harbor Blvd. Suite 217, Oxnard, CA 93035

Phone: 805-382-6151

Fax: 805-382-9791

Objectives:

Naturalist Corps volunteers are trained by CINMS and the Channel Islands National Park service (CINP) to educate the public on board local marine excursion vessels conducting whale watch tours, natural history tours, and island trips. Naturalist Corps volunteers receive training in marine mammal field identification and marine mammal research. Research objectives of the program include the development of a comprehensive database of incidental marine mammal sightings and reports collected in the Santa Barbara Channel, CINMS, and CINP.

Questions:

- What marine mammals and how many are sighted in the CINMS per year?
- Where are feeding congregations of large baleen whales in the CINMS?

Data Collected Since: March 2000

Frequency of Data Collection:

At a minimum of a weekly basis from January – October depending on availability of Naturalist Corps volunteers and whale-watching vessels.

Data Type:

Please see attached marine mammal sightings form.

Research Program: Naturalist Corps

Availability of Data:

Hard copies of all surveys are kept on file. Portions of the data have been entered into Excel for educational use on the Web. The data is currently available in hard copy only. CINMS will develop an online Marine Mammal Sightings Database in 2003 that can be queried in the Web by researchers, educators, and the general public.

Techniques:

Naturalist Corps Marine Mammal Sightings data is entirely opportunistic. Data points are collected on varying transects with sightings being considered incidental. All sightings are recorded onto a physical data sheet using a shipboard GPS to record location. Species identifications are recorded based on confidence levels of the observer. Many of the Naturalist Corps volunteers have conducted surveys for a minimum of 2 years and work with vessel captains that have been tracking marine mammals for up to 20 years. Distance covered and effort can vary from 10 – 80 nautical miles depending on weather and particular marine mammal seasons.

Number of Species Studied:

Surveys record sightings of any of the 28 species of cetaceans that occur in the Santa Barbara Channel and CINMS. Twenty (20) species of marine mammals were positively identified in 2002. California sea lions and harbor seals are not recorded on a regular basis. Only entangled or tagged sea lions and harbor seals are reported. Rare pinniped (northern elephant seal, northern fur seal, Stellar sea lion, Guadalupe fur seal) and southern sea otter sightings are recorded.

Species List: (Marine Mammals Recorded by Naturalist Corps in 2002)

Blue Whale (*Balaenoptera musculus*)
Gray Whale (*Eschrichtius robustus*)
Humpback Whale (*Megaptera novaeangliae*)
Minke Whale (*Balaenoptera acutorostrata*)
Fin Whale (*Balaenoptera physalus*)
Bryde's Whale (*Balaenoptera edeni*)
Northern Right Whale (*Balaena glacialis*)
Sperm Whale (*Physeter macrocephalus*)
Orca (*Orcinus orca*)
Northern Right Whale Dolphin (*Lissodelphis borealis*)
Common Dolphin (*Delphinus capensis* and *Delphinus delphis*)
Pacific White-sided Dolphin (*Lagenorhynchus obliquidens*)
Dall's Porpoise (*Phocoenoides dalli*)
Risso's Dolphin (*Grampus griseus*)
Bottlenose Dolphin (*Tursiops truncatus*) nearshore and offshore pods
Beaked Whale (unidentified sp.)

Research Program: Naturalist Corps

Species List: (cont.)

California Sea Lion (*Zalophus californianus*)

Harbor Sea (*Phoca vitulina*)

Northern Elephant Seal (*Mirounga angustirostris*)

Southern Sea Otter (*Enhydra lutris*)

Number of Sites:

Transects are conducted in the entire Santa Barbara Channel on whale-watching vessels from Santa Barbara, Ventura, and Channel Islands harbors.

Location of Sites:

Incidental sightings are recorded along variable transects along the mainland coast between Point Conception and Point Mugu, in the Santa Barbara Channel, and nearshore San Miguel, Santa Rosa, Santa Cruz, and Anacapa islands; primarily on the north side of the islands in the western portion of the Channel. In 2003 transects may cover the north and south sides of Anacapa Island and the eastern portion of Santa Cruz Island.

Staff Available for Monitoring:

CINMS and CINP facilitated the training of over 90 Naturalist Corps volunteers in 2003. Volunteers conduct marine mammal surveys and whale photo-identification from January – October (In 2002, the season was extended to 12 months). A CINMS intern will be trained to enter 2000 –2002 Marine Mammal Sightings data into a new interactive Web database. In addition, CINMS staff will also conduct incidental marine mammal surveys while on duty in the Sanctuary.

Resources Available for Monitoring:

Over 8 marine excursion vessel operators support the Naturalist Corps program out of Santa Barbara, Ventura, and Channel Islands harbors. CINMS provides the training, data sheets, and field equipment for volunteers and participating vessels.

Annual Funding Level and Source:

CINMS presently funds the Naturalist Corps program. The Channel Islands National Park Service and the Channel Islands Marine Sanctuary Foundation also support the program.

Research Program: Collaborative Marine Research Program

Agency or Institution: Channel Islands National Marine Sanctuary (CINMS), California Department of Fish and Game, National Marine Fisheries Service, Sea Grant, and local fishermen

Contact: Sarah Fangman

Email: Sarah.Fangman@noaa.gov

Address: 113 Harbor Way, Suite 150, Santa Barbara, CA 93109

Phone: 805-884-1473

Fax: 805-568-1582

Objectives:

Questions:

Data Collected Since:

Frequency of Data Collection:

Data Type:

Availability of Data:

Techniques:

Number of Species Studied: 13

Species List:

Ocean whitefish

Blacksmith

Black surfperch

Opaleye

Garibaldi

Halfmoon

Kelp bass

Kelp rockfish

Brown rockfish

California scorpionfish

Cabezon

Research Program: Collaborative Marine Research Program

Species List: (cont.)

California sheephead

Treefish

Number of Sites: 1

Location of Sites: East island of Anacapa Island, north shore

Staff Available for Monitoring:

Resources Available for Monitoring:

Annual Funding Level and Source:

\$50,000 from the Channel Islands National Marine Sanctuary

Research Program: Sanctuary Aerial Monitoring Spatial Analysis Program (SAMSAP)

Agency or Institution: Channel Islands National Marine Sanctuary

Contact: Ben Waltenberger

Email: ben.waltenberger@noaa.gov

Address: Channel Islands National Marine Sanctuary, 113 Harbor Way, Suite 150, Santa Barbara, CA 93109

Phone: 805-884-1461

Fax: 831-568-1582

Objectives:

To map mammal and vessel distributions and to provide emergency response

Questions: Where, when and what?

- Where are marine mammals?
- When are they in that location?
- What kinds of marine mammals are there?
- Where are commercial and recreational vessels?
- When are the vessels on the water?
- What kinds of vessels are on the water?
- Are there any patterns of mammal and/or vessel distribution?
- What factors likely influence the distributions of marine mammals and vessels?

Data Collected Since: August 1997

Frequency of Data Collection: Weekly

Data Type:

Mammal species, time, and location; vessel type, time, location. Additional data collected during emergency response includes the location and area covered by an oil spill or vessel grounding event and the affected resources.

Availability of Data:

Data is stored in Microsoft Excel spreadsheets and GIS shapefiles.

Data is available to the public

Research Program: Sanctuary Aerial Monitoring Spatial Analysis Program (SAMSAP)

Techniques:

Double aerial transects within the Channel Islands National Marine Sanctuary conducted once each week.

Number of Species Studied: Any marine mammals in the Sanctuary

Species List: Whales and dolphins

Location of Study Sites:

Study sites are the entire area within the boundaries of the Channel Islands National Marine Sanctuary

Staff Available for Monitoring:

Two staff members are provided once a week.

Resources Available for Monitoring:

Lake Seawolf Aircraft

Annual Funding Level and Source:

\$50,000 per year from National Oceanic and Atmospheric Administration and National Ocean Service

Category 3: Environment (Physical oceanography or habitat)

Research Program: CODAR

Agency or Institution: University of California, Santa Barbara

Contact: Dr. Libe Washburn

Email: washburn@geog.ucsb.edu

Address: Geography Department, University of California, Santa Barbara, CA 93106-4060

Phone: 805-893-7367

Fax:

Objectives: To obtain data on the surface circulation in the Santa Barbara Channel

Questions:

- What is the pattern of surface circulation in the Santa Barbara Channel?

Data Collected Since: December 1997 (west Santa Barbara Channel)

Frequency of Data Collection: Hourly maps of surface currents are collected from two sites at present: Refugio and Coal Oil Point.

Data Type:

Data are observations of surface currents (upper 1 m) averaged over circles of 3 km radius interpolated on a 2 km grid.

Availability of Data:

What format is used to store the data? Data are stored in a format readable by an analysis program called MATLAB.

Are the data available to the public? Data are available to the public. GIF image files are available at <http://www.icess.ucsb.edu/iog/codar>.

Techniques:

High frequency radars collect data out to a range of 42 km offshore. Coverage maps for each month are available at the website listed above.

Research Program: CODAR

Number of Sites: Two radar sites are currently in operation. Principal investigators plan to install 4 more radar sites over the course of the next year or two.

Location of Sites: See Map 23

Staff Available for Monitoring:

Four technicians, researchers and programmers conduct the research.

Resources Available for Monitoring:

Several UCSB boats, cars, and trucks are available.

Annual Funding Level and Source: \$200,000-\$250,000 per year from Minerals

Management Service, National Science Foundation, Packard Foundation and NASA.

Map 23: CODAR

Research Program: Remote Sensing of the Channel Islands National Marine Sanctuary

Agency or Institution: Channel Islands National Marine Sanctuary

Contact: Ben Waltenberger

Email: ben.waltenberger@noaa.gov

Address: Channel Islands National Marine Sanctuary, 113 Harbor Way, Suite 150, Santa Barbara, CA 93109

Phone: 805-884-1461

Fax: 831-568-1582

Objectives: To collect aerial and orbital imagery and ROV data

Questions:

- What is the sea surface temperature?
- Has the shoreline location changed over time?
- What habitats are on the bottom of the ocean?

Data Collected Since: 1997

Frequency of Data Collection: Variable

Data Type:

Imagery, digital orthophoto quadrangles (DOQs), light detection and ranging (LIDAR), sea surface temperature (SST), reflectance, and underwater video.

Availability of Data:

Data is stored in digital form and a majority of the data is available.

Techniques:

Orbital platforms, aerial transects, opportunistic ROV tracks

Number of Sites: Entire Channel Islands National Marine Sanctuary

Location of Sites: Entire Channel Islands National Marine Sanctuary

Staff Available for Monitoring: Variable

Research Program: Remote Sensing of the Channel Islands National Marine Sanctuary

Resources Available for Monitoring:

NOAA Orbital Platforms, Lake Seawolf Aircraft, and ROVs when available.

Annual Funding Level and Source:

Annual funding level is variable. Sources of funding are National Oceanic and Atmospheric Administration and National Ocean Service or other partnerships.

Research Program: Side Scan Sonar Mapping of the Sea Floor

Agency or Institution: United States Geological Surveys (USGS) Coastal and Marine Geology Program

Contact: Dr. Guy R. Cochrane

Email: gcochrane@usgs.gov

Address: 345 Middlefield Rd., MS-999, Menlo Park, CA 94025

Phone: 650-329-5076

Objectives: To map benthic habitat

Questions:

- Do existing and proposed reserves provide the types of habitat needed for endangered and threatened benthic species?
- Where should Marine Protected Areas (MPA's) be located?
- Where should juvenile white abalone be seeded?
- How much change should we expect in MPA habitat due to geological processes over time?

Data Collected Since: 1998

Frequency of Data Collection: Yearly

Data Type:

100 Khz sidescan sonar, 40 Khz subbottom profiles, bottom video

Availability of Data:

1 m pixel sidescan sonar tiff world files available online at walrus.wr.usgs.gov/nearshorehab, polygon habitat shape files, other related shape files produced from video and sub-bottom data.

Techniques:

Sonar images have continuous coverage of bottom except where accidental loss of swath overlap occurs.

Research Program: Side Scan Sonar Mapping of the Sea Floor

Number of Species Studied:

Habitat maps are predominantly physical habitat although some attached epifauna or infauna may be included.

Number of Sites: 4 sites in press, 4 more to be published this year.

Location of Sites:

Channel Islands, Southern California coastal nearshore 0-100 m water depth.

Staff Available for Monitoring:

1 research staff, 1 GIS tech

Resources Available for Monitoring:

100/500 Khz sidescan, chirp high-resolution sub-bottom profiler, trackpoint II, bottom cameras, sampling equipment.

Annual Funding Level and Source:

USGS OE, supplemented by NOAA who provide ship time and some OE.

Map 24: Side Scan Sonar Mapping of the Sea Floor

Category 4: Ecosystems (Habitat and multi-species complexes)

Research Program: Bight '98

Agency or Institution: Channel Islands National Marine Sanctuary

Contact: Sarah Fangman

Email: sarah.fangman@noaa.gov

Address: 113 Harbor Way, Santa Barbara, CA 93109

Phone: 805-884-1473

Fax: 805-568-1582

Objectives:

Questions:

- What is the spatial extent of contaminants in southern California?
- What is the spatial extent of storm water on the coastal ocean?

Data Collected: throughout the Southern California Bight since 1994 and at the Channel Islands since 1998.

Frequency of Data Collection:

First survey was done in summer 1994 (Channel Islands not included); the survey was repeated and expanded in 1998 (Channel Islands included) and will be repeated in summer 2003.

Data Type:

1998 survey (Channel Islands included):

Sediment sampling at 446 sites (37 at Channel Islands)

>100 chemical constituents measured

Toxicity and infauna measured to assess effects

Trawl sampling at 313 sites (31 at Channel Islands)

Debris

Tissue contaminants (fish)

Gross pathology (fish)

Bomarkers

Assemblages (fish and invertebrates); data on abundance, biomass, Species richness, diversity and distribution

Research Program: Bight '98

Data Type: 1998 survey (cont.)

Water Quality:
Storm event/dry weather
CTD casts at 535 sites

Availability of Data:

What format is used to store the data? Access database

Are the data available to the public? Not yet.

Techniques:

A 0.1 m² modified Van Veen grab was used to collect sediment samples for physical, chemical and infaunal analysis. Details of deployment/grab acceptance/processing provided upon request.

A semi-balloon otter trawl was used to collect epibenthic invertebrates and demersal fish. Net dimensions were the following: 7.6-m headrope (25 ft); 8.8-m footrope (29 ft); 3.8-cm (1.5 in) body mesh; and 1.3-cm (0.5 in) cod-end mesh. The net had a 22.9-m (75 ft) long bridles and the doors had a width of 76.2-cm (30 in) and height of 50.8-cm (20 in).

Number of Species Studied:

Species List:

Number of Sites: 37 sediment grabs around Channel Islands; 31 trawls.

Location of Sites: See Map 25

Staff Available for Monitoring:

Two (2) staff

Resources Available for Monitoring:

Two (2) vessels (one 28' and one 62') and one aircraft

Annual Funding Level and Source:

NOAA Channel Islands National Marine Sanctuary funding: \$20,000 per year.

Map 25: Bight '98

Research Program: Plumes and Blooms

Agency or Institution: Institute for Computation Earth System Sciences

Contact: Dave Siegel; Olga Polyakov

Email: davey@icess.ucsb.edu; olga@icess.ucsb.edu

Address: ICESS / UCSB, 6th floor Ellison Hall, Santa Barbara, CA 93106

Phone: 805-893-2544

Fax: 805-893-2578

Objectives:

The goal of the Plumes and Blooms (PnB) project is to develop, validate and apply to imagery state-of-the-art ocean color algorithms for quantifying sediment *plumes* and phytoplankton *blooms* for the Case II environment (influenced by both oceanographic and terrestrial processes) of the Santa Barbara Channel.

Questions:

PnB field data is used to objectively tune semi-analytical models of ocean color for the Channel Islands region and apply them using available satellite imagery (SeaWiFS and MODIS). The PnB data set also is being used to address time/space variability of water masses in the Santa Barbara Channel and its relationship to the 1997/1998 El Niño. PnB researchers have been active in various outreach activities.

Data Collected: August 1996 – present

Frequency of Data Collection: Monthly or bimonthly sampling

Research Program: Plumes and Blooms

Data Type:

Physical properties	temperature and salinity profiles (CTD)
Inherent Optical Properties	absorption and beam attenuation (AC9), backscatter (hs6), transmissometer and fluorometer
Ambient Light Attenuation	light profile (PRR)
Discrete Water Samples	absorption spectra, fluorometric chlorophyll a, phytoplankton pigment (HPLC samples run by SDSU CHORS), inorganic nutrients, biogenic and lithogenic silica concentrations
Remote Sensing	operate delayed mode ground station for SeaWiFS (ocean color) and AVHRR (SST) imagery

Availability of Data:

What format is used to store the data?

Data collected by electronic instruments is stored as processed text files.

Are the data available to the public?

Data is available to public via ftp and internet (<http://www.icesb.ucsb.edu/PnB/PnB.html>)

Techniques:

Each station includes a cast with CTD, transmissometer, fluorometer, AC9, and HS6.

During this cast, water is collected using Niskin bottles and filtered on the boat for later analysis. Water is collected at the surface at all stations and with a depth profile at station 4. This is followed by an optics cast with the PRR. Sampling protocols are available at <http://www.icesb.ucsb.edu/PnB/MethodsManual.html>

Research Program: Plumes and Blooms

Number of Sites: 7

Location of Sites: See Map 26

Staff Available for Monitoring:

PnB supports two full time staff researchers, several partial lines and a graduate student researcher. Staff may be able to help on selected monitoring efforts.

Resources Available for Monitoring:

CTD/rosette, AC9 absorption/beam attenuation meter, HS6 backscatter meter, PRR profiling spectroradiometer, TeraScan satellite data acquisition system

Annual Funding Level and Source:

PnB funding is about \$200,000 per year but ends November 2003.
Principal investigators will attempt to renew the proposal.

Map 26: Plumes and Blooms

Research Program: Santa Barbara Coastal Long Term Ecological Research Program (LTER), National Science Foundation

Agency or Institution: Marine Science Institute, University of California, Santa Barbara

Contact: Jenny Dugan or Dan Reed

Email: j_dugan@lifesci.ucsb.edu or reed@lifesci.ucsb.edu

Address: Marine Science Institute, University of California, Santa Barbara, CA 93106-6150

Phone: 805-893-2675 or 805-893-8363

Fax: 805-893-8062

Objectives: To investigate the relative importance of land and ocean processes and inputs in structuring giant kelp (*Macrocystis pyrifera*) forest ecosystems.

Questions: To determine the effects of land and ocean inputs on the primary production of kelp, and the population dynamics, community structure, and ecosystem responses of kelp forests, we are measuring and modeling the patterns, transport, and processing of material constituents (e.g., nutrients, carbon, sediment, organisms, and pollutants) from terrestrial watersheds and the coastal ocean to shallow reefs where kelp forests occur.

Our primary research questions concern

- Patterns, transport, and processing of organic and inorganic inputs to coastal reefs,
- Patterns and control of primary production in kelp forests,
- Disturbance and population dynamics of kelp forest communities, and
- Species interactions, trophic structure and food web dynamics in kelp forest communities.

Data Collected Since: See "Location of Sites" below.

Frequency of Data Collection: See "Data Type" below.

Research Program: Santa Barbara Coastal Long Term Ecological Research Program (LTER), National Science Foundation

Data Type:

Measurement	Frequency
Density and size structure of kelp biota	Annually
Chemical composition of giant kelp [Carbon (C), Nitrogen (N), stable C & N isotopes]	Monthly
Estimates of net primary production in giant kelp	Monthly
Phytoplankton abundance (optical measure of chlorophyll <i>a</i> at midwater)	Every few minutes
Phytoplankton abundance (direct measure of chlorophyll <i>a</i> at bottom, midwater, surface)	Monthly
Percent cover of benthic algae and sessile invertebrates	Annual
Biomass of benthic algae and fish prey	Annual
Reef fish density and size structure	Monthly
Abundance of reef fish	3 times per year in fall
Salinity – midwater	Every few minutes
Salinity – water column profile	Monthly
Seawater temperature – bottom, midwater, near surface	Every few minutes
Seawater temperature – water column profile	Monthly
Turbidity - midwater (optical backscatter sensor)	Every few minutes
Turbidity – water column profile (optical backscatter sensor)	Monthly
Nitrate – midwater	Every few minutes for intermittent periods
Dissolved nitrate, ammonia, silicate, phosphorous - bottom, midwater, surface	Monthly
Particulate carbon, nitrogen and silica, stable C & N isotopes - bottom, midwater, surface	Monthly
Ocean currents - 0.5 m intervals throughout water column	Every few minutes

Availability of Data:

Databases for each data type are in development.

Data will be made available to the public via our project website:

<http://sbc.lternet.edu/index.html>

Research Program: Santa Barbara Coastal Long Term Ecological Research Program (LTER), National Science Foundation

Number of Species Studied: Over 150 species of algae, plants, fishes and benthic invertebrates are studied.

Species List: Available on our website: <http://sbc.lternet.edu/index.html>

Group	Taxon	Species
Algae	Chlorophyta	Many species
	Phaeophyta	Many species
	Rhodophyta	Many species
Seagrass	Tracheophyta	2 species
Sponges	Porifera	3 species
Hydroids	Cnidaria (Anthozoa)	<i>Aglaophenia</i> spp.
Anemones	Cnidaria (Anthozoa)	Many species
Gorgonians		3 species
Polychaete worms	Annelida (Polychaeta)	Many species
Abalone	Mollusca (Gastropoda)	4 species
Snails, Whelks, Limpets	Mollusca (Gastropoda)	Many species
Scallops, Mussels, Clams	Mollusca (Bivalvia)	4 species
Octopus	Mollusca (Cephalopoda)	Several species
Barnacles	Arthropoda (Crustacea)	Several species
Lobsters	Arthropoda (Crustacea)	<i>Panulirus interruptus</i>
Crabs	Arthropoda (Crustacea)	3 species
Bryozoans	Ectoprocta	4 species
Sea Cucumbers	Echinodermata (Holothuroidea)	5 species
Sea Urchin	Echinodermata (Echinoidea)	3 species
Sea Stars	Echinodermata (Asteroidea)	9 species
Tunicates	Chordata (Urochordata)	4 species

Research Program: Santa Barbara Coastal Long Term Ecological Research Program (LTER), National Science Foundation

Number of Sites:

26 reef sites

Several oceanographic tracks

32 stream sampling sites in 10 watersheds

Location of Sites: Bulito, Arroyo Hondo, Arroyo Quemado, Naples Reef, Isla Vista, Goleta Bay, Arroyo Burro, Mohawk Reef, Carpinteria Reef, Diablo (Santa Cruz Island), Fry's Harbor (3 sites), Fern (2 sites), BC (2 sites), Twin Harbor (2 sites).

Staff Available for Monitoring:

The number of staff members available for monitoring varies according to subgroup.

Resources Available for Monitoring:

University of California boats and vehicles are used for kelp forest research. Time-series water column measurements are conducted aboard university boats. Oceanographic research cruises are conducted aboard NOAA National Marine Sanctuary and Channel Islands National Park ships. Permanent moorings with a fluorometer, backscatter meter and conductivity, temperature, pressure sensors are deployed at three reef sites near the mainland coast. An ADCP is deployed on the bottom near the moorings. Five HF units are arrayed along the mainland coast to provide information on surface currents. Imagery is obtained from the SeaWiFS and AVHRR satellites. The images are downloaded and processed regularly at UCSB.

Annual Funding Level and Source: The level of funding varies. The sources include the National Science Foundation – Long Term Ecological Research program, NASA, Packard Foundation and others.

Map 27: Santa Barbara Coastal Long-Term Ecological Research (LTER) Program

Research Program: California Cooperative Oceanic Fisheries Investigations (CalCOFI)

Agency or Institution: California Department of Fish and Game, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, University of California, Scripps Institution of Oceanography

Contact: Russ Vetter

Email: rvetter@ucsd.edu

Address: 8604 La Jolla Shores Drive, La Jolla, CA 92038-0271

Phone: 858-546-7125

Fax: 858-546-5656

Objectives:

CalCOFI was formed in 1949 to study the ecological aspects of the collapse of the sardine populations off California. Today its focus has shifted to the study of the marine environment off the coast of California and the management of its living resources.

Questions:

- What is the physical characterization (including temperature, salinity, oxygen, current patterns) of the Southern California Bight?
- What is the nutrient content and productivity of the southern California Bight?
- What is the spatial distribution and abundance of plankton throughout the Southern California Bight?
- What is the spatial distribution and abundance of fish eggs, larvae, marine birds, and marine mammals in the Southern California Bight?
- What is the spatial and temporal abundance of ichthyoplankton taxa or categories?

Data Collected Since: 1951

Research Program: CalCOFI

Frequency of Data Collection:

Interval	Frequency
1951-1960	Monthly
1961-1965	Annual surveys with quarterly cruises that included six to eight months of the year
1966-1984	Triennially, typically with eight to eleven months represented in the samples
1985-present	Annual with quarterly cruises that include samples from four to seven months each year

Data Type:

At each station a whole suite of physical and chemical measurements are made to characterize the environment and map the distribution and abundance of phytoplankton, zooplankton and fish eggs and larvae.

- Meteorological observations
- Temperature, salinity, oxygen
- Water masses and currents
- Nutrients
- Primary production
- Phyto- and zooplankton biomass and biodiversity
- Distribution and abundance of fish eggs and larvae, marine birds, and mammals
- Spatial and temporal abundance of ichthyoplankton taxa or categories

Availability of Data:

Data are published in CalCOFI reports and atlases, available online at www.calcofi.org.

Techniques:

Routine station activities include CTD/Rosette casts to 500-m depth, bottom depth permitting, with continuous measurements of pressure, temperature, conductivity, dissolved oxygen and chlorophyll fluorescence. Water samples are collected at 20 depths, with variable spacing depending on depth of the chlorophyll, oxygen and salinity extrema and the thermocline depth (*Hayward and Venrick, 1998*). Salinity, oxygen and nutrients are determined for all depths sampled, while chlorophyll-*a* and phaeopigments are determined within the top 200 m, bottom depth permitting. Details of the standard sampling and analysis procedures can be found in any of the recent CalCOFI data reports.

Research Program: CalCOFI

Techniques: cont.

The primary method used to collect plankton is a basic plankton net tow. Double oblique tows are used with a cable pay-out rate of 50 m per minute and a retrieval rate of 20 m per minute at a constant wire angle. There has been some variation in gear and maximum tow depth since 1951. Tows from 1951 through 1968 employed a 1-m ring net towed to a depth of 140 m. Beginning in 1969, the nominal tow depth was increased to 210 m and the 71-cm bongo net replaced the ring net from the last cruise in 1977 to the present. Silk mesh (0.55 mm opening), used from 1951 to 1968, was replaced by nylon mesh (0.505 mm opening) in 1969. Samples were preserved in 5% formalin aboard ship and returned to the laboratory where zooplankton displacement volumes (expressed as ml per 1000 m³) were determined and fish eggs and larvae were removed.

The Continuous, Underway Fish Egg Sampler, CUFES, is used to collect pelagic eggs of fish, and ancillary data, from ca. 3-m depth from a moving research vessel. These samples and data are, in turn, used to investigate spawning habitat and estimate spawning biomass.

Number of Species Studied:

310 total larval taxa (including unidentified and disintegrated categories) including 160 ichthyoplankton taxa or categories

Species List:

Available online at www.calcofi.org.

Number of Sites:

66 standard stations in the Southern California Bight region

Location of Sites:

Northern California to Cabo San Lucas, Mexico

Staff Available for Monitoring:

At sea, the crew for CTD and plankton surveys includes 4 people; however there are 14 scientific bunks available and all are filled.

Resources Available for Monitoring:

Ship time aboard NOAA Ship *David Starr Jordan*, Scripps R/V *New Horizon*, Scripps R/V *Roger Revelle*. Scripps Institution of Oceanography processes phytoplankton and zooplankton samples. Scripps Institution of Oceanography and National Marine Fisheries Service process data on physical oceanography.

Research Program: CalCOFI

Annual Funding Level and Source:

The annual cost of the program is approximately \$1 million. In addition, numerous staff salaries are funded by participating agencies. CalCOFI research is supported by contributions California Department of Fish and Game, NOAA, National Marine Fisheries Service, Southwest Fisheries Science Center, and the University of California, Integrative Oceanography Division at the Scripps Institution of Oceanography, University of California at San Diego. Additional support for the development of the annual data CD is provided by NOAA, Office of Ocean and Atmospheric Research.

References:

Hayward, T.L., and E.L. Venrick, 1998. Nearsurface pattern in the California Current: Coupling between physical and biological structure, *Deep-Sea Research II*, 45: 1617-1638.

Map 28: California Cooperative Oceanic Fisheries Investigations (CalCOFI)

Research Program: Egg and Larval Fish Production from Marine Ecological Reserves

Agency or Institution: California Department of Fish and Game, California Sea Grant, and National Marine Fisheries Service

Contact: Russ Vetter

Email: rvetter@ucsd.edu

Address: 8604 La Jolla Shores Drive, La Jolla, CA 92038-0271

Phone: 858-546-7125

Fax: 858-546-5656

Objectives:

- To determine the effectiveness of the Vandenberg and Big Sycamore Canyon Marine Ecological Reserves as source areas for the production of fish eggs and larvae that will "reseed" areas outside of the Reserves.
- To produce a full description of available habitat within marine reserves.
- To determine the prevailing current patterns that drive larval dispersal and juvenile recruitment during winter and summer.
- To compile a list of the resident fish fauna, including resettlement juveniles, in reserves.
- To compare the fine-scale pattern of spawning events within the reserves and in adjacent areas, and the dispersal patterns of eggs and larvae.

Data Collected Since: 1997

Frequency of Data Collection:

June 1997 – May 1998: Laboratory work to obtain diagnostic molecular identification protocols for the fish families of interest; diver transect surveys of habitat and fish fauna.

December 1997 – March 1998: Winter cruise

June – August 1998: Summer cruise

August 1998 – December 1998: Sort and analyze data from the summer cruise

December 1998 – March 1999: Winter cruise

June – August 1999: Summer cruise

June – December 1999: Complete sample analysis and write research results

Research Program: Egg and Larval Fish Production

Data Type:

Physical habitat description
Current patterns
Adult and juvenile fish fauna
Fish and larval production

Availability of Data:

Proposal available at
<http://swfsc.nmfs.noaa.gov/frd/Other%20Projects/merrp/MERRP2.htm>
Report available on cd (Marine Ecological Reserves Research Program: Research Results 1996-2001. California Sea Grant, 9500 Gilman Drive, La Jolla, CA 92093. Phone: 858-534-4440).

Techniques:

Substrate mapping
Current profiling
Diver surveys and live trapping
Bongo sampling
MOCNESS sampling
Egg pump sampling
Egg incubation
Visual and molecular identification

Number of Species Studied: All fish eggs, larvae, and adults

Number of Sites: Two (2) coastal ecological reserves

Location of Sites: Vandenberg Ecological Reserve in Santa Barbara County and Big Sycamore Canyon Ecological Reserve in Ventura County

Staff Available for Monitoring:

Principal investigators Russ Vetter, Geoffrey Moser, William Watson, as well as graduate student assistants and technical staff

Resources Available for Monitoring:

D/S David Star Jordan; formerly R/V Ballena

Annual Funding Level and Source:

Year one: \$416,025 with \$75,035 from Marine Ecological Reserves Research Program (MERRP)
Year two: \$413,301 with \$69,943 from MERRP
Year three: \$134,983 with \$70,069 from MERRP

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